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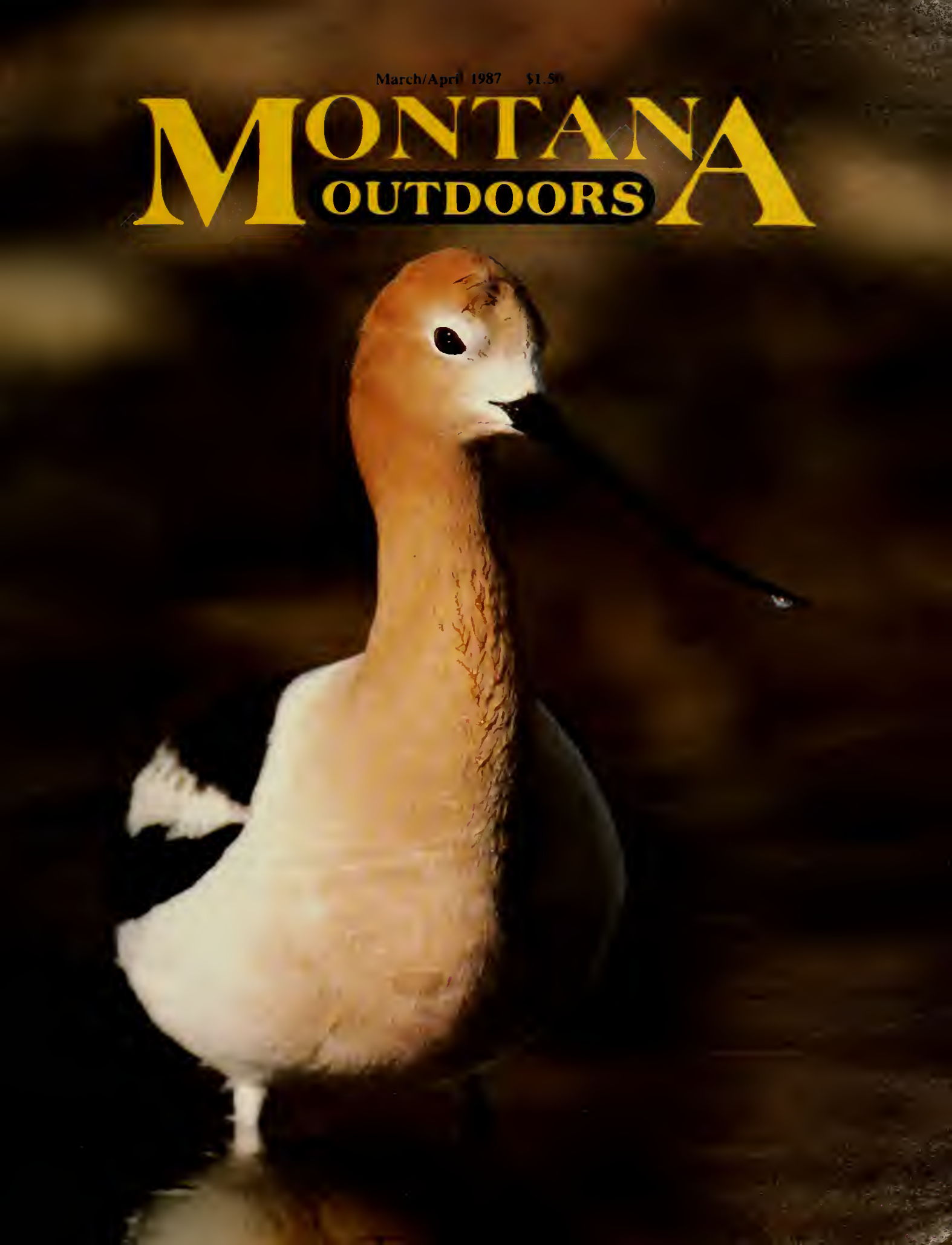

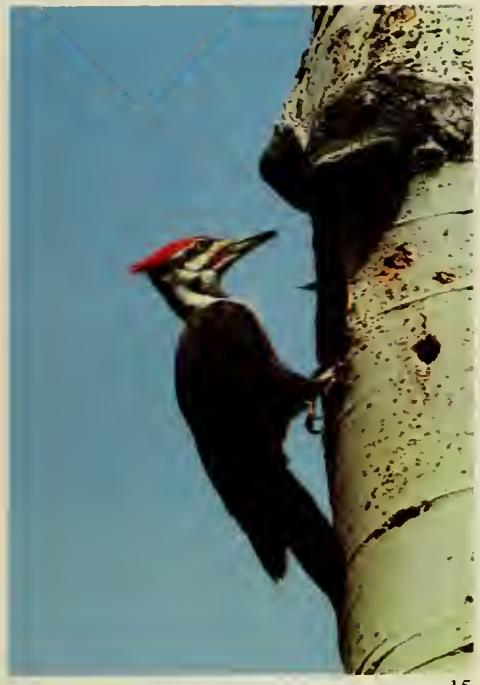

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MONTANA OUTDOORS

March/April 1987
Volume 18, Number 2

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COVERS

Meriwether Lewis called it the "Missouri plover" or "party coloured plover," and his detailed description of this large shorebird marveled at its unusual upward-curving bill. Keith Szafranski's front cover photo makes one realize the aptness of Lewis' "party coloured plover" as compared with the name by which we know it: American avocet. The sage grouse, photographed for our inside front cover by Conrad Rowe, was among the birds "new to science" discovered and documented by the Lewis and Clark expedition. Join the National Wildlife Federation in marking the 49th National Wildlife Week, March 15-21. The colorful background of sky and clouds on this issue's back cover poster frame the theme for the week: "We Care About Clean Air."

It's an annual ritual. You leave a warm bed in the middle of the night to drive for hours in the cold darkness. The "butterflies" in your stomach flutter as you turn off the pavement and begin winding your way into the mountains. An hour before sunrise, you pull off the road and park, just as you did last year and the year before. You get out of the truck, shoulder your pack, sling your rifle over your shoulder, and slowly make your way up the slope. It's another opening of elk season.

But things are different this year. You cross a road you've never crossed before. A hundred yards farther you cross it again as it switchbacks up the slope with you. At daybreak you're on the ridge top, ready to hunt the dense timber at the edge of a familiar meadow. Instead, you find yourself standing in a long, narrow swath cut through the forest. The clearing is about 125 feet wide and extends as far as your eyes can see. The new road you crossed earlier winds in and out of the clearing all along its length. You wonder if you made a wrong turn somewhere during the night.

This may have happened to you if you returned to hunt elk in the Clark Fork River drainage of west central Montana in 1984. Earlier that year, a corridor and access road network were cut through forests along a 156-mile route from Garrison, Mont., west to Taft, near the Idaho border. If you hunted in the same spot in 1985, you found huge steel towers, about 175 feet tall, erected every quarter-mile or so in the center of the right-of-way. Steel conductors, energized at 500,000 volts, stretched from tower to tower. If it was raining or snowing during your visit, the conductors were actually humming and crackling because of the high voltage. This portion of the powerline, known officially as the "Garrison-Taft 500 kV Transmission Project," is the middle leg of a system for transporting electricity generated at Colstrip, Mont., to utilities and their customers in Montana and the Pacific Northwest.

Does this affect your elk hunting? If you demand an "unspoiled" backcountry setting for your elk hunt, it certainly does. Maybe the presence of the powerline and corridor doesn't "spoil" your

ELK UNDER

THE WIRE

by Mike Thompson
illustrated by Robert Spannring

experience as long as there's no traffic on the access roads. Or, maybe the corridor and new roads improve your hunting by leading you through bedding and feeding sites that were less accessible before. There are, no doubt, as many human reactions to the powerline and roads as there are humans.

But what about the elk? Will they remain in traditionally used habitats along the powerline corridor? Will they be attracted to new forage sources created by the corridor, or will they abandon the area completely? If elk remain near the corridor, will they be more vulnerable to hunters because of the improved access? If elk abandon the area around the corridor, will they find suitable habitat elsewhere? Finally, how will this affect your opportunities to hunt elk in this area in the future? These are questions the Montana Department of Fish, Wildlife and Parks (DFWP), the Department of Natural Resources and Conservation (DNRC), the Bonneville Power Administration (BPA), and the U.S. Forest Service (USFS) have been tackling since 1983.

The concerns for elk and elk hunting stem mainly from the specific route taken by the transmission project through western Montana. Several possible routes were proposed and evaluated by federal and state agencies responsible for locating the transmission line. A joint state-federal study team weighed the pros and cons of each route, considering environmental, social, economic, engineering, and public concerns. Two years of investigation and debate led to selection of a preferred route in 1983.

Compared with other routes studied, this route minimizes impacts of the transmission line project on people. It avoids private residences and agricultural lands wherever possible, and is hidden from public view along major highways by the mountain slopes it crosses. These are important considerations in a state renowned for its unspoiled landscapes.

While minimizing impacts on people, however, this route posed the greatest risk of impact on elk and elk hunting. To avoid private lands, the transmission line was routed through large blocks of public land administered primarily by the Deerlodge and Lolo National forests. In fact, almost 75% of the 156-

"There are, no doubt, as many human reactions to the powerline and roads as there are humans. But what about the elk? Will they remain in traditionally used habitats along the powerline corridor?"

mile route through western Montana crosses national forest lands. Since more than 80% of all elk hunting in Montana occurs on public lands, primarily national forests, the potential for conflict with elk management is easily envisioned.

Actually, the transmission line and towers are of less concern than the roads built to construct and maintain them. The BPA required that each tower be accessible by road for future maintenance. To the extent possible, the route took advantage of existing roads on public lands. Nevertheless, the transmission line crossed many miles of previously roadless backcountry, which necessitated constructing about 280 miles of new access roads. Many of these new roads were built through summer and fall elk habitat.

What is the source of conflict between elk habitat and roads? The answer, as you might expect, is people. Studies of elk responses to logging in Montana and other states typically have found declines in elk use from 1/8 mile to 1-1/4 miles away from vehicle traffic on roads. The impacts of roads are magnified during hunting season, because the elk that remain in roaded areas are more vulnerable to hunting pressure and harvest. This can cause declines in local elk numbers, and in the number of older bulls in the population, leading to more restrictive hunting regulations and reduced hunting opportunity if elk populations fall below acceptable levels. Reduced hunting opportunity is contrary to DFWP elk management goals and is a less desirable alternative than maintaining adequate elk security along the powerline.

Recognizing the potential for adverse impacts on elk and elk hunting, the state-federal study team concluded that an elk study was necessary. One goal of the study, which began in 1983 and will continue until 1988, was to document impacts of the project on elk and elk hunting. More important, however, the study was intended to minimize the adverse impacts of the transmission project by identifying problems and finding solutions.

The "problem-solving" nature of this study requires close cooperation of all public agencies involved. The BPA funded the study, although certain functions have been additionally supported by the Lolo National Forest, DFWP, and the Rocky Mountain Elk Foundation. The study is being conducted by the DFWP and DNRC, but representatives from the state, BPA, two national forests, and the Bureau of Land Management actively participate in study direction and application of results.

Since it would be impractical to conduct detailed field studies along the entire 156-mile route, two study areas were selected at opposite ends of the project corridor. The eastern study area, referred to as the Harvey-Eightmile area, is part of Elk Hunting District (HD) 210, about 30 miles southwest of Missoula. The western study area, referred to as the DeBorgia area, is part of HD 200, about 10 miles west of St. Regis. Both study areas contain large blocks of previously unroaded elk habitat that were crossed by the transmission project.

Fall elk distribution was monitored in both study areas, beginning in September 1983 (before project construction). Not surprisingly, preliminary results suggest that elk use declined in previously unroaded habitats along the transmission route when construction was ongoing during the hunting seasons of 1984 and 1985. However, effects of construction disturbances appeared to be reduced outside of the hunting season. Although the new powerline access roads were closed to public vehicles during hunting season, they provided improved access to previously roadless elk habitat for hunters on foot and horseback. Thus, closed roads provided more security for elk than open roads, but did not completely compensate for loss of security resulting from the new road system. This, coupled with construction activity, appeared to cause elk to more noticeably avoid the powerline during hunting season.

Since elk moved away from the access roads, one might have expected the elk harvest to remain relatively unaffected by the powerline project, assuming elk could find adequate security cover elsewhere. Preliminary study results in HD 210, however, suggest that the harvest of yearling bull (spike) elk in 1984 was actually higher than would have been expected before the powerline and new roads were built. It was impossible to identify impacts on the harvest of cow elk or older bulls because of changes in hunting regulations and other factors that complicated the analysis.

Much work remains to verify these

early results, but two findings of previous studies in Montana provide evidence that the new roads in HD 210 might have contributed to an increased spike harvest. First, elk harvest rates and hunting pressure are higher along roads than in areas more difficult to reach. Consequently, elk that remained in newly roaded habitats in 1984 were more likely to be harvested than they were before the roads were built. Second, closing roads to vehicles sometimes causes an increased elk harvest because hunters spend more time walking, rather than driving. Thus, the new roads in HD 210 led hunters through more elk habitat in 1984 than before, and may have helped those hunters be more effective.

Although an unusually high spike harvest in 1984 was suspected to be a result of the transmission project in HD 210, we don't know if this was a common occurrence along the entire transmission route, or if this kind of impact will persist in the future. This is because much of the information being used to analyze elk harvests in HD 210 is not available in the other four hunting districts crossed by the route. However, indications are that elk harvests at the opposite end of the route, near the Idaho border, may not have been affected greatly, if at all.

These "indications" come from the elk themselves. Elk were captured and equipped with radio transmitters on summer ranges in the DeBorgia study area in 1984 and 1985. In all, 18 individuals (12 cows and 6 bulls) were captured by luring them into box traps with salt blocks. Upon entering a trap, the elk inadvertently kicks a trip wire, causing the trap door to close behind it. Biologists then cut the trap's guy wires, allowing the metal frame to collapse and the sides of nylon netting to fold around the elk. With the elk restrained, a radio-transmitting collar is attached. When the elk is released, it can be relocated from the ground or a small aircraft by a biologist using a radio receiver and antenna. Using these techniques, biologists were able to record the responses of individual elk to hunting pressure along the transmission route in 1985.

On the opening day of the 1985 hunting season, many of the radio-equipped elk in HD 200 were located on summer-fall ranges within one mile of roads. However, elk were on the steep

MIKE THOMPSON

Concerns for elk and elk hunting prompted a study of the effects of this transmission line built through western Montana in 1984. The DeBorgia study area (bottom photo) near St. Regis contains large blocks of elk habitat that were previously unroaded. Elk captured and fitted with radio transmitters provided valuable data on how the powerline affected elk behavior and hunting seasons.

CATHY HAMMOND

MIKE THOMPSON

upper slopes and ridge lines above road systems. Most hunters elected to stay close to the roads, which are generally restricted to drainage bottoms, rather than climb the densely forested slopes that separated them from elk. As a result, few hunters encountered elk until later in the hunting season, when snow caused elk to leave their secure habitats. The vulnerability of elk to harvest during such periods of fall migration is a source of concern, but did not appear to increase substantially as a result of the powerline project. Although it is legal for hunters to shoot radio-equipped elk during hunting season, only one of the 18 elk was taken in either 1984 or 1985.

Consequently, effects of the transmission project on elk harvests in HD 200 appear minimal compared with those suspected in HD 210. There are several possible reasons for this. First, many new project roads did not provide improved access to ridge tops and upper slopes frequented by elk in HD 200, while the opposite was true in HD 210. Second, HD 200 is more extensively forested than HD 210, reducing the vulnerability of elk along the new roads in HD 200 compared with HD 210. Third, elk in the dense forests of HD 200 are found in smaller groups and are more widely scattered than in the more open habitats of HD 210. Thus, elk are more difficult for hunters to find in HD 200, and often fewer elk are found in any single location.

The transmission project roads improved access to elk habitat for others besides transmission project personnel and hunters. Loggers potentially gained access to previously inaccessible timber stands as a result of the new roads. In fact, many of these timber stands were not logged previously because of the high expense of building access roads. The new project roads greatly reduce or eliminate that expense, increasing the economic feasibility of logging in elk habitat. The losses of hiding cover for elk that would result from logging along the new roads would compound the effects of the transmission project on elk and elk hunting.

Since most of the elk habitat along the transmission route is public land, future logging along the new roads can be regulated in the public interest, balancing the needs of elk against demands for other resources and land uses. Recognizing that public land management along the transmission route will not be directed exclusively toward elk, detailed information on elk habitats and requirements must be gathered and made available, with recommendations, to decision makers. Information gathering and exchange is facilitated by DFWP's participation with the USFS in the planning of timber sales on national forest lands along the powerline route. This is a major function of the transmission project elk study, and will continue through August of 1988.

So, how will the transmission project affect opportunities to harvest elk in your favorite hunting spot? Since project impacts are primarily the result of increased access created by the new roads, the answer to that question depends on the extent of new roading. Many stretches of the transmission route had already been extensively logged and roaded before the project started. Few new roads were required for the project in these areas, so impacts were minimal beyond short-term construction disturbances. Locations such as the two study areas, however, were largely unroaded prior to the transmission project. New road construction and subsequent impacts were greatest in these types of locations.

If your hunting spot was extensively roaded as a result of the transmission project, the degree to which your future hunting will be affected will depend on several management decisions. Actions such as road closures and retention of important elk hiding cover will be employed as necessary to reduce elk vulnerability in "problem areas." Timber management along the transmission route will be influenced by the need to provide cover for elk and reduce project impacts. These and other appropriate steps will be taken to maintain existing opportunities to hunt elk.

The transmission project brought much more than a change of scenery to elk habitat. It also brought human demands and the potential for a variety of activities that could affect elk populations and hunting opportunities. State and federal resource managers recognize the potential for conflicts between human needs and the needs of elk. Their commitment to avoid and minimize adverse impacts on elk and elk hunting will be a test of our ability to successfully integrate development and wildlife interests.■

"The transmission project brought much more than a change of scenery to elk habitat. It also brought human demands and the potential for a variety of activities that could affect elk populations and hunting opportunities."

• *This study is the result of the previous and continuing efforts of many individuals in the Department of Fish, Wildlife and Parks; the Department of Natural Resources and Conservation; the Bonneville Power Administration; the Lolo and Deerlodge National forests; the Bureau of Land Management; and other members of the public. I am only one of the participants. I greatly appreciate the time and effort spent by the others in preparation and review of this article.* —Mike Thompson

Seeker of Solace

by Don Skaar

This secret is meant to be told—Montana has a healthy common loon population, the only one in the western United States outside Alaska. People who live at some of Montana's lakes know loons are around, as do bird watchers and fishermen who visit the lakes. But until as recently as five years ago, nobody had any idea that 150 to 200 loons spent the summer in Montana.

In 1982, a group of scientists began studying loons to try to find out how large and healthy the population was. Their efforts, known as the Montana Loon Study, are largely supported by the North American Loon Fund, a New Hampshire group that sponsors research and education to protect the loon. Since 1982, support for, and participation in, the Montana Loon Study has grown. Over 50 volunteers help with education and monitoring efforts. Cooperating biologists from the Montana Department of Fish, Wildlife and Parks (DFWP), the U.S. Forest Service (USFS), and Glacier National Park are

photo: CAL RYDER

also involved with monitoring the population and initial phases of management.

Simply stated, the goal of the Montana Loon Study is *to protect the loon and its habitat by using a three-pronged approach: research, education, and management.*

Research efforts are concentrating on identifying the needs of nesting loons and identifying threats to successful reproduction. We have learned that loons arrive in Montana in late April, probably from the Pacific Coast or Gulf of Mexico. Migrants immediately head to nesting grounds in the northwestern corner of the state, almost exclusively west of the Continental Divide. The North Fork of the Flathead River (including Glacier National Park) and the Tobacco-Stillwater River drainages north of Kalispell support the most nesting birds.

Studies in other states show that the birds probably return to the same lake year after year, sometimes arriving before the ice is gone. They often nest at the same site, and the female usually lays her eggs (almost always two) by mid- or late May. Chicks hatch after a 28- or 29-day incubation, and as nestlings are "precocial"—they are born with eyes open, their bodies are covered with down, and they follow the adults to water within 24 hours.

Still, the chicks rely almost totally on their parents for food in the first few weeks of life, and frequently hitch rides on their parents' backs. Their dependence on the adults gradually wanes through the summer, although they can't fly until 10 or 11 weeks. By the time they begin flying, one of the adults probably will have left the lake to seek other feeding areas. There is a good chance the other adult will leave the lake before the chicks do, giving them more time to store energy for migration in October and November.

We have also found that loons are quite choosy about where they will nest. Early in our research, we realized they don't use lakes smaller than 10 acres, perhaps due in part to their need for at least 100 to 400 feet of open water on which to take off.

For a variety of reasons, they also avoid lakes at elevations of over 5,000 feet. Most high-elevation lakes in northwestern Montana are in glacial cirques and are deep and relatively unproductive. Also, the season when the high lakes have no ice may be too short to attract loons since they require about

Nautical Dream, Aerial Nightmare

The common loon is only one of many species of truly aquatic birds that inhabit freshwater and marine environments. While all of these birds swim and dive well underwater, they can functionally be divided into two groups—foot-propelled (feet alone propel the bird, and wings are merely used to "steer") and wing-propelled (wings are used as flippers or paddles). The loon belongs to the foot-propelled group, which includes cormorants, grebes, and diving ducks like scoters and eiders; the wing-propelled group includes diving petrels, auklets, puffins, and penguins.

All of these birds share many adaptations to an aquatic life—including webbed or lobed feet, dense plumage, and solid bones. Since water is a denser medium than air, diving birds have bodies that are more spindle-shaped than the bodies of terrestrial flying birds. The diving bird's body will be long and cylindrical, with its center of gravity toward the rear, while flying birds will typically be broad and blunt in front, tapering to a slender tail.

The loon has solid bones rather than bones filled with air. This gives it a specific gravity near that of water. A heavier body makes it easier for the loon to dive, as does its ability to void air from its body by compressing its feathers, and by expelling air from the air sacs in its body cavity. This ability to change specific gravity explains why one moment you see a loon sitting on top of the water and the next moment you see it with only its head above the water.

A heavy body is necessary for a bird that spends much time underwater pursuing fish. The loon spends up to three minutes submerged on a single dive, and dives as deep as 180 feet. It is physiologically capable of these long underwater dives because of the large amount of myoglobin in its muscles (myoglobin is a respiratory pigment that can store large quantities of oxygen). Loons also have a slow heart rate and many of their organs are able to operate with a reduced oxygen supply.

Probably the most important physical adaptations of the loon are those enabling it to propel itself swiftly underwater—powerful legs and small wings. The leg muscles are held against the body, with only the leg from the ankle bone down capable of free movement. With the leg attaching so far back on the body, the bird has unidirectional, torpedo-like propulsion. The power of the leg strokes is aided by development of the cnemial crest, an extension of the tibia near the knee joint. This extension allows additional muscles to propel the webbed feet.

Small wings are necessary for life in the water because they reduce drag and make swimming energy-efficient. The loon has what is called high "wing-loading," which means that it has small wings supporting a heavy body. This is in contrast to most terrestrial birds, such as the American crow which has the same size wings as the loon, but is only 25% as heavy. The consequence of high wing-loading for the loon is its inability to soar and the need to beat its wings quickly just to stay aloft. In addition, the loon needs 100 to 400 feet of "running room," before flight is gained.

While evolution has developed this formidable underwater eating machine, it has also made the bird one of the biggest clowns out of the water. Because of the fact that its legs are attached toward its rear section, the loon walks erect on land with great effort. "Walk" isn't even really the word; most movement on land is only the distance from water to nest (less than five feet) and the loon pushes its breast and body along the ground with its legs. This is why the word "loon" comes from the old Scandinavian word "lom," meaning a lame or clumsy person.

The combination of small wings and legs attached so far toward the rear has the most comical consequences when the loon lands, always on water. Because its wings have so little lift, a steep descent is impossible, and a gliding landing is mandatory. Also, because of the leg attachment, landing with feet placed forward to brake the landing doesn't work. While this may make you think of a crippled jetliner going down in the ocean, the landing actually has a certain grace to it—wings arched upward, legs held back, and a big V-shaped plume of water upon landing.

four months to bring their chicks off a lake. Another possibility we have speculated about is that the air at these high altitudes is so thin that it may make infeasible the already laborious task of taking flight.

Whatever the case, the loon's pickiness doesn't stop here. It seems to prefer to nest on shallow lakes, or at least lakes with shallow, productive areas that provide high-density food sources for loon chicks. They normally choose a lake with fish, their favorite food, although they are occasionally found on fishless lakes.

The loon also needs seclusion, and it doesn't tolerate high levels of human disturbance. This is another critical aspect of the loon's choice of a lake for nesting. In general, loons won't successfully nest on small lakes (10 to 20 acres or slightly larger) unless they are relatively free of people, or on large lakes unless there is an undisturbed portion. Exactly what type of disturbance—roads, campgrounds, houses, trails, boats—and how much of it the loon can tolerate is something we are trying to determine.

Probably the most disruptive aspect of human disturbance is timing. Even the busiest nesting lakes in Montana—McGregor, Seeley, Salmon, Bull (south of Libby)—are pretty quiet in mid-May when nesting begins, but then become swamped with people and boats beginning on Memorial Day weekend. We suspect that many loons are attracted to these lakes for nesting, but with the coming of Memorial Day are forced to abandon nests or expend energy in nest defense.

Unfortunately, human disturbance often provokes an intolerant behavioral response from the loon that can lead to nest abandonment and/or chicks dying. A loon pair I discovered on Tally Lake in 1983 was so intolerant that they protested vociferously when I came closer than 400 yards. On another lake, a loon that I accidentally scared off its nest would not return until I had moved 300 yards away and hidden from view. Problems occur during these periods of defense and preoccupation with intruders. Disoriented or distracted loons sometimes lose or abandon chicks and/or nests. When some loons see a human approaching, they will slip off the nest and into the water to avoid giving away the nest's location. While the adults are off the nest and away from the eggs, the eggs are easy prey for ravens, raccoons, skunks, and other animals.

CAL RYDER

Loons are choosy about where they nest; they prefer shallow, secluded lakes with a good supply of food for their chicks. They avoid lakes smaller than 10 acres and those at elevations above 5,000 feet.

DON SKAAR

The effect of human disturbance on annual chick production is unknown because it's very difficult to collect a complete record of all disturbances. Information on successfully nesting pairs indicates that an average of 1.4 chicks is raised per successful nesting pair, arising from an average clutch size (number of eggs per nest) of nearly 1.9.

The Montana Loon Study has tried to inform people that what loons need most is a little peace and quiet. Most negative interactions between loon and man are unintentional. If lake users learn to recognize when to leave loons alone and what areas to avoid, then many of the problems with human disturbance should diminish. We have cooperated with the Flathead National Forest in creating television public service announcements which discuss loons, and are currently cooperating on a 15-minute videocassette. This cassette will be available to citizen groups, resource agencies, and schools.

Another exciting phase of our work is called "vocal tagging"—identifying individual male loons by their yodel (or territorial) calls. This is an important step on the national scene as well. Because banding loons is laborious, identifying individuals by their calls alone is appealing. We have started to do this in Montana, and much of the preliminary work was done in 1986 by Lynn Kelly, a graduate student at Montana State University.

What is the prognosis for loons in Montana? Unfortunately, accurate population and production figures aren't available because intensive census work did not start until 1986. However, it is safe to speculate that before European man settled northwestern Montana, loons probably nested on at least 50% more lakes than they do today. The

reduced number of available lakes is most likely due to increased human activity. While the loon population is almost certainly down from 100 to 200 years ago, we cannot positively say whether the current population is stable or declining. I suspect it is slowly declining due to (1) the large number of non-nesting or unsuccessfully nesting birds in the region (50% to 60% of the total adult population) and (2) the fact that human disturbance does interfere with chick production.

One indication of the current potential for declining populations is the "threat" status of current nesting lakes. We have grouped the lakes into low-, medium-, and high-threat categories, depending on the amount of disturbance they receive. Thirty percent of nesting lakes can be grouped in the "high-threat" category, meaning loon nesting success is threatened now or may be in the near future by existing high levels of disturbance in the form of water level fluctuations, boats, roads, campgrounds, houses, or human activity.

There's plenty of work to be done in the future. First, researchers need to determine if the population is declining. We also need to understand why nests fail and chicks die. We need a statewide management plan for the loon, with the goal of maintaining a stable population and establishing a monitoring system to verify this. The plan should also provide on-the-ground managers with specific information on precautions to take and remedies available to prevent human disturbance at nest sites and rearing areas.

Perhaps the best way to protect a species such as the common loon is through a cooperative agency/volunteer program, with resource agencies focusing on management and enforcement, and volunteers and conservation groups focusing on monitoring and censusing. Montana Loon Study volunteers have led the way in this effort, with DFWP and USFS personnel providing support.

The Northern Region of the USFS recently designated 12 species—including the loon—for its "sensitive species" list. Because of this listing, the USFS has the directive to use its resources to protect the loon on the lands it administers. We believe this designation will signal the beginning of a fruitful collaboration between state and federal agencies and concerned citizens to protect this beautiful, reclusive bird. ■

BOOK REVIEWS

MONTANA'S EARLY-DAY RANGERS, by Robert C. (Bert) Gildart, Montana Magazine, Inc., P.O. Box 5630, Helena, MT 59604; 1985 (second edition, 1987), 135 pages, $7.50, soft cover.

If you're looking for a book to go along with a quiet evening and a crackling fire, consider "Montana's Early-Day Rangers." In this book, Kalispell author Bert Gildart strings together old-timers' personal narratives, gathered from interviews and early park and Forest Service records, to tell the story of the life of early U.S. Forest Service and National Park Service rangers.

You'll listen to 100-year-old Clyde Fickes tell of blasting a pack rat from a cabin's rafters with a .44-caliber pistol, only to watch the dispatched rodent plop into his sourdough mix. Buckskin Charley narrates an elk roping fiasco, and Hank Tuttle describes his difficulty in removing "undesirable prostitutes" from federal land.

Ranger Leon Lake tells of his troubles with "Dunn Creek Nell" who thought nothing of firing on rangers who approached her abode. Lake reports that "she had killed one husband, one or two had died mysteriously, and another had fled."

Gildart includes acccounts of some of the early rangers who lived on the edge of the law. Besides being a ranger, colorful Slippery Bill Morrison was a gambler and saloon owner. Notorious Joe Cosley was finally dismissed by the Park Service in Glacier because of his illegal trapping activities.

Accompanying the stories of trails and lookouts, squatters and lawbreakers, avalanches and snowstorms, are descriptions of the military roots of federal rangers, tales of rangers' wives, and stories of the early rangers' contributions to wildlife management. Gildart allows the principals in the stories to do most of the talking, which makes for vivid reading. The 46 black and white photos complement the old-timers' yarns.

"Montana's Early-Day Rangers" is a valuable collection of narratives about a time when conditions for federal rangers were harsh, but job descriptions were simple: "Go and range." The book serves as a journal for these independent men and women and the untamed land of early-day Montana.—*John Fraley, contract project leader, Fisheries Division, Region 1 (Kalispell)*

THE ONLY GOOD BEAR IS A DEAD BEAR: A COLLECTION OF THE WEST'S BEST BEAR STORIES, by Jeanette Prodgers, Falcon Press Publishing Co., Inc., P.O. Box 731, Helena, MT 59601; 1986, 224 pages, $7.95, soft cover.

Of all Montana's wildlife, bears—especially grizzly bears—seem to have the widest following in the popular press. Lest you think this is a modern trend, reading Jeanette Prodgers' collection of early-day bear stories will convince you otherwise. Judging from these accounts, most of which were culled from turn-of-the-century publications, bears have always made hot newspaper and magazine copy.

Luckily for bruin, the book's title, "The Only Good Bear Is a Dead Bear," no longer sums up the prevailing public sentiment. Where it once was considered one's "civic duty" to kill any and all bears encountered, most westerners today are willing to live and let live.

The stories make it clear that the grizzly bear was king of the forest in frontier times, an animal possessed of extraordinary strength and vitality. Wounded grizzlies sent more than a few bear hunters to an early grave.

But the stories provide more than information about bears and bear behavior. They also provide an entertaining glimpse into the lives of the hardy souls who settled the frontier. Take the story of M.D. Hatheway, printer, prospector, and resident of Montana Territory in the 1860s, who while out grouse hunting ran into a grizzly and was terribly mauled. After a lengthy convalescence at a nearby ranch, he went to Butte for supplies, only to find that the newspapers had run his obituary several months before. He later reported, "I was pretty well liked in those days, and the papers all gave me a good sendoff, and I have the pleasure, which few men ever have, of reading the good things the press had to say of me after I was reported to be dead."

Then, too, there are some tips for coping with a bear emergency. Suppose you have found yourself up a not-too-comfortable tree, with an angry grizzly bear camped below; in your understandable haste to get beyond reach of bruin's teeth and claws, you dropped your rifle at the base of the tree when you began to climb. Oregon bear hunter John Griffin found himself in this predicament in the early 1900s. The solution? Simple: Fashion a hook from a tree branch, cut your overalls into narrow strips to make a rope and, while the bear is distracted by your faithful hunting dog, snag the rifle by the lever and hoist it up to your perch—then make things hot for bruin!

While this story is ostensibly true, our ancestors had a notable penchant for exaggeration when it came to bear stories. One section of the book, appropriately titled "Unbearable Tall Tales," is devoted to "...imaginative tall tales concocted by lonesome cowboys, long-winded politicians and fanciful prospectors."

The stories in this book, whether tragic or humorous, true or fictional, offer plenty of good reading. In addition, they make an important contribution to the steadily growing literature on bears of western North America.—*Dave Books*

THE CATCHALL

A "Bully" Idea

At the foot of the Rocky Mountains, about 15 miles west of the small town of Dupuyer, Mont., sprawls a 6,000-acre ranch where the conservation ethic of former President Teddy Roosevelt thrives.

The land, through which runs trout-filled Dupuyer Creek, is home at least seasonally to a wealth of wildlife species—to every species present at the time of settlement, in fact, with the exception of the bison.

The area is prime winter range for elk and white-tailed and mule deer. These large mammals share the place with eagles, hawks, falcons, owls, grouse, pheasants, partridges, Canada geese, and ducks. Other denizens of the ranch and nearby property include grizzly and black bears, mountain lions, mountain goats, bighorn sheep, and wolves.

Traditionally, the land has supported a considerable number of cattle as well.

Abundant wildlife, suitability for ranching, and only limited local oil and gas exploration make the area an ideal site for conservation-oriented research sponsored by the Boone and Crockett Club.

The club, founded almost a century ago by Teddy Roosevelt, bought the Triple Divide Ranch in 1985 and renamed it the Theodore Roosevelt Memorial (TRM) Ranch. The invitation-only club, whose regular members number just over 100, is an official keeper of hunting statistics on North American big game. The group also sponsors graduate level wildlife research, promotes conservation measures, and encourages wildlife education for hunters and non-hunters alike.

The University of Montana is a prime beneficiary of the club's purchase of the ranch. The club plans to raise $900,000 for UM—the interest from which will pay a Boone and Crockett research professor's salary and finance research projects. The professor, not yet chosen, will conduct research on the relationship between livestock operations, wildlife needs, and vegetation, a subject of great interest to ranchers throughout North America.

"Some ranchers forego considerable benefits to have wildlife on their ranches," says Dan Poole, a professional (advisory) member of the club, president of the Wildlife Management Institute, and a UM graduate. "We aim to make the 'foregoing' a little bit less painful."

In addition to serving as a field experiment station, the ranch will stay in the cattle business. The club plans to put 100 of its own cattle on the property and has selected neighboring rancher Tom Salansky as the TRM ranch manager.

The research professor will have plenty of company at the ranch, where three houses will permit researchers to work year round in comfort. State and federal agency researchers, UM faculty, and graduate and post-graduate students from UM and other universities will perform research there. Interested ranchers will also be able to learn more about managing their land for the benefit of both wildlife and livestock.

The land will be open to hunting for those who get permission from the ranch manager. The exception will be Boone and Crockett club members, for whom the land will be off-limits for hunting.

The relationship between the club and UM is an unusual one. "As far as I know, this is an unprecedented sort of arrangement," says Prof. Lee Metzgar, director of UM's Wildlife Biology Program. "It's not as if we're getting an endowment and then can go and 'do our thing' forever. The endowment is contingent upon five-year reviews by UM and the club, so the club will remain in perpetuity an active partner in the activities that go on at the ranch."

If a review shows that the ranch program hasn't met the goals set forth in the club's agreement with UM, the university will have to return the club's $900,000.

UM faculty, Boone and Crockett Club members, ranchers, and wildlife and range specialists recently gathered in Missoula to set priorities for studies to be done at the ranch. The Oct. 6-8 conference drew participants from 11 states, the District of Columbia, and the Province of Alberta.

The group voted top research priority to effects of vegetation management on range quality, economic return, wildlife, and livestock. Other high-ranked topics were public hunting options, the nutritional quality of plants as used by livestock and wildlife, and the physiological responses of wildlife to their environment.

The group also voted to determine high-priority baseline studies, in which scientists assess the current status of an area so they can monitor changes in it. Vegetation again emerged as the No. I priority. Developing an information management system and compiling a history of the ranch that would include human, biological, and wildlife aspects also were ranked high. A fourth emphasis was documenting wildlife habitat use and birth and growth rates.

Conference participants expressed high hopes for the future of the TRM Ranch as a research site. Bill Wishart, a wildlife research biologist from Alberta, said Canada is anxious for results from the ranch studies. "We don't have a lot of data saying what the best recipe" is for managing wildlife, livestock, and vegetation, he says. "You may come up with a good recipe here that's applicable to the front ranges on both sides of the Rockies."

Don Klebenow, University of Nevada wildlife management professor and a UM graduate, believes the ranch has great potential as an education center. "They plan to be really selective of graduate students and put them on significant projects," he says. "So there's potential for turning out leaders of national significance in wildlife management." *—Carol Susan Woodruff, UM News and Publications*

Holton Named "Fish Pro"

George Holton, assistant administrator of the Department of Fish, Wildlife and Parks Fisheries Division, has been selected as "The Fisheries Professional of the Year" by his fellow fishery workers in the Montana Chapter of the American Fisheries Society (AFS). Holton has worked with the DFWP for 29 years.

James E. Darling, awards committee chairman for the Montana Chapter, listed the establishment of a computerized fishery data base for Montana as among the many "quiet, unselfish contributions" Holton has made toward the conservation and preservation of the state's fishery. He also mentioned Holton's work with endangered fish species conservation in announcing the award.

AFS is the oldest conservation society for natural resource professionals in North America.

Thanks, Art Whitney

If you've caught a wild trout in any of Montana's prized rivers or streams, you ought to thank Art Whitney.

About halfway through Whitney's 23-year tenure as administrator of the Department of Fish, Wildlife and Parks (DFWP) Fisheries Division, he spoke out against planting catchable trout.

Some biologists in western states and Montana sportsmen didn't agree with Whitney's belief that planting hatchery-bred trout in rivers and streams was not only a waste of money but also was not a very wise way to treat a river.

Whitney and a team of department biologists—armed with information gathered from a limited research project on the Madison River—championed the idea that if the naturally spawned fish in rivers no longer had to compete with the big hatchery-planted trout, the river and stream fishery

would restore itself.

The notion was so radical—and Whitney so adamant—that a Fish and Game Commissioner asked Whitney at a public meeting if he would be willing to resign if his theory proved wrong.

He didn't have to resign, and on Dec. 31, 1986, he ended a 35-year career with the DFWP. Since that mid-1970s battle, the DFWP has stopped planting fish in rivers and streams and some other states have followed Montana's lead by cutting back on planting trout in rivers. Montana's hatchery fish are now almost exclusively planted in lakes and ponds.

Under Whitney's direction, the modern philosophy of habitat protection was ushered in. It wasn't enough to simply stop planting catchable trout in the rivers to restore naturally spawned trout. The health of the river depended on the health of the surrounding environment. As Whitney has often said, "When your rivers and streams are in good shape, the rest of your environment has to be in good shape."

Whitney, a past president of the American Fisheries Society, the oldest conservation society for natural resource professionals, began his career with the DFWP in 1951 at the Miles City Hatchery as a warm-water fishery biologist. His tenure as administrator of the Fisheries Division has encompassed five DFWP directors, five Montana governors, and five U.S. presidents. He was initially appointed to the post in 1963 by former DFWP Director Frank Dunkle, now

GENE FISCHER

Art Whitney

chief of the U.S. Fish and Wildlife Service.

"I can't think of anything I would have rather worked at for the past 35 years," Whitney commented. "There are only 50 jobs like mine in the country and I've worked in one of the best states, with the best fisheries resource in the world. A person couldn't ask for more than that."

Skipper's Inspection List

It's spring. And it's not too early to begin a preseason checkup on your motorboat. Before that first launch, all watercraft should be thoroughly inspected. This may well save you repair costs—to say nothing of the potential for a life-threatening situation.

Out of the Water

With the vessel out of the water and dry, inspect the area below the waterline. Clean oil or plant growth off the hull. This will enable you to more easily spot holes, scrapes, or scratches. Look for discoloration that could indicate water seepage, and have all holes repaired. A clean hull reduces drag once you put the boat in the water, too.

The mechanical workings of motor-powered vessels should be checked every year. Below is a list of items to inspect *before* you put your vessel into the water:

- Never start the motor out of the water; internal damage *will* occur.
- Visually inspect the steering system for correct operation and lubricate it.
- Remove the battery from the vessel, charge it, correct the water level, clean the connections, and put it back in.
- Clean and regap or replace the spark plugs.
- Top off the lower unit with appropriate lubricant.
- Lubricate grease fittings on the motor.
- Check all lubricant levels—motor oil, power steering fluid, and power trim fluid.
- Check the condition of the propeller.
- Check engine synchronization and timing.
- Check the Pitot tube on the speedometer line.

U.S. Coast Guard Minimum Equipment Requirements for Motorboats

EQUIPMENT	CLASS A (less then 16 ft.) (less then 4.9m)	CLASS 1 (16 to less then 26 ft.) (4.9 to less then 7.9m)	CLASS 2 (26 to less then 40 ft.) (7.9 to less then 12.2m)	CLASS 3 (40 to not more then 65 ft.) (12.2 to not more then 19.8m)
BACK-FIRE FLAME ARRESTOR	One approved device on each carburetor of all gasoline engines installed after April 25, 1940, except outboard motors.			
VENTILATION Boats built before August 1, 1980.	At least two ventilator ducts fitted with cowls or their equivalent for the purpose of properly and efficiently ventiliating the bilges of every closed engine and fuel-tank compartment of boats constructed or decked over after April 25, 1940, using gasoline as fuel or other fuels having a flash-point of 110° or less.			
Boats built on August 1, 1980, or later.	At least two ventilator ducts fitted with cowls or their equivalent for the purpose of efficiently ventiliating every closed compartment that contains a gasoline engine having a cranking motor and every closed compartment containing a gasoline tank, except those having permanently installed tanks which vent outside the boat and which contain no unprotected electrical devices. Also, engine compartments must contain power opereted exhaust blowers which can be controlled from the instrument panel.			
PERSONAL FLOTATION DEVICES (PFD's)	One approved Type I, II, III or IV PFD for each person on board or being towed on water skiis, etc.	One approved Type I, II or III device aboard for each person on board or being towed on water skiis, etc.; and, in addition, one throwable Type IV device.		
BELL, WHISTLE	Every vessel less than 12 meters (39.2 ft.) in length must carry an efficient sound producing device.		Every vessel less than 12 meters (39.2 ft.) but less then 20 meters (65.6 ft.) in length must carry a whistle and a bell. The whistle must be audible for ½ nautical mile. The mouth of the bell must be at least 200 mm (7.87 inches) in diameter.	
VISUAL DISTRESS SIGNALS (Required on coastal waters only; see Chap. 20)	Only required at night. Must carry three visual distress signals approved for nighttime use.	Must carry three visual distress signals approved for daytime use and three approved for use at night. Three combination day/night signals may be substituted. NOTE: All boats carrying six or more passengers for hire must meet these requirements also.		
FIRE EXTINGUISHER-PORTABLE When NO FIXED fire extinguishing system is installed in machinery space(s).	At least one B-I type approved hand portable fire extinguisher. (Not required on outboard motorboats less than 26 feet in length and not carrying passengers for hire if the construction of such motorboats will not permit the entrepment of explosive or flammable gases or vapors and if fuel tanks are not permanently installed.)		At least two B-I type approved portable fire extinguishers; OR at least one B-II type approved portable fire extinguisher.	At least three B-I type approved portable fire extinguishers; OR at least one B-I type plus one B-II type approved portable fire extinguisher.
When FIXED fire extinguishing system is installed in machinery space(s).	None.	None.	At least one B-I type approved portable fire extinguisher.	At least two B-I type approved portable fire extinguishers; OR at least one B-II type approved portable fire extinguisher.

- Check lighting systems on the boat and trailer.
- Check for loose nuts and bolts on motor, boat, and trailer.
- Check belts and alternator on all motors.
- Check the fuel system for leaks at connections and primer bulbs.
- Check the ventilation system for plugged vents and proper fan operation.
- Locate the drain plug and replace it.
- Check trailer tire pressure.
- Check tie-downs from boat to trailer.
- Check trailer hitch for proper operation and fit.
- Lubricate trailer wheel bearings and check for wear.
- Inspect safety chains from trailer to vehicle.
- Inspect the rubber seal between the inboard motor and the outboard drive system.

Obtain the 1987 boat registration decal from the county treasurer. After this has been completed and any corrections made, the vessel is ready for the water.

In the Water

- Check for leaks under the seats, etc.
- At the dock, start the engine and warm it up.
- Check the water pump to make sure it is functioning.
- Check operation of the transmission lever, but only when the engine is running.

If you have concerns or need assistance, contact an authorized boat service center in your area.

Essential Equipment

To meet state and federal safety standards, every vessel must have certain equipment available. These standards are common-sense precautions and are in place to protect all boaters.

The accompanying chart describes what is required in motorboats of various sizes. *All equipment must be in good working order.* Canoes, kayaks, and rafts are classified as vessels and must have PFDs for all persons on board. Children under 12 years old must wear a PFD of the correct size at all times while in the vessel. Check PFDs by squeezing to determine if they are leaking, and destroy any that are because they won't work properly. Inspect the backfire flame arrestor and engine ventilation system for correct operation and have them serviced if necessary. Have your fire extinguisher checked and serviced by an authorized service center.

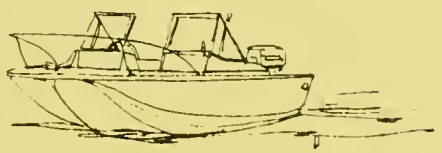
These precautions should be taken to *prevent* accidents. As a boat owner, a safe boat is your responsibility.

The Department of Fish, Wildlife and Parks has more information on boat and water safety. Contact any regional office, or the Helena headquarters (406/444-4046). *—Tim Pool, supervisor, Recreation Safety Education Program*

Skipper's Quiz

For all of you skippers getting ready to head to Montana's waterways, here's a quiz to test your knowledge of the state's boating laws and safety regulations and to sharpen your nautical skills. The answers follow the quiz.

1. Boat registration decals should be displayed on:
   (a) each side of the back end of the boat.
   (b) the starboard side in the center of the boat.
   (c) each side of the forward half of the boat.
   (d) the windshield of the boat.
2. According to Montana law, no person may operate a motorboat that is towing a person or persons on water skis or similar devices unless the operator is accompanied by an observer at least _____ years of age or older.
   (a) 10
   (b) 12
   (c) 15
   (d) 16
3. To help a person out of the water, do all of the following except:
   (a) approach slowly, motoring upwind.
   (b) keep the motor running when alongside the person.
   (c) try to bring the person in over the stern.
   (d) balance the boat so it does not roll too much when the person crawls aboard.
4. If a boat capsizes, it's usually best to:
   (a) swim away from the boat toward shore.
   (b) grab a lifesaving device and hold on to the boat.
   (c) take off all clothes and tread water.
   (d) grab a lifesaving device and swim to shore.
5. If a fire starts on board the boat, do *not*:
   (a) keep the fire downwind.
   (b) speed up to try and put the fire out.
   (c) grab the extinguisher, activate it, and direct it at the base of the flames.
   (d) put out a distress signal.
6. Signs and symptoms of hypothermia may include all of the following except:
   (a) skin becomes blue-grey in color.
   (b) violent shivering and muscle spasms occur.
   (c) the victim is unable to sleep.
   (d) confusion and slow, slurred speech become evident.
7. Initial recommended treatments for hypothermia do *not* include:
   (a) move victim out of the wind and rain and into a warm blanket.
   (b) warm beverages.
   (c) alcohol and massaging of the limbs.
   (d) strip off all wet clothes and warm the victim with skin-to-skin contact.
8. By law, registration decals are required on which of the following:
   (a) sailboats.
   (b) motorboats.
   (c) canoes.
   (d) all of the above.
9. Any person who has not reached his or her _____ birthday shall always wear an approved personal flotation device (PFD) when occupying a motorboat or vessel under 26 feet in length.
   (a) 18th
   (b) 16th
   (c) 14th
   (d) 12th



10. If caught in foul weather, a boater should:
    (a) reduce speed and head toward the nearest shore.
    (b) be sure that all passengers are wearing PFDs.
    (c) head the bow into waves at a slight angle.
    (d) secure loose items and seat passengers on the bottom of the boat near the center.
    (e) all of the above.

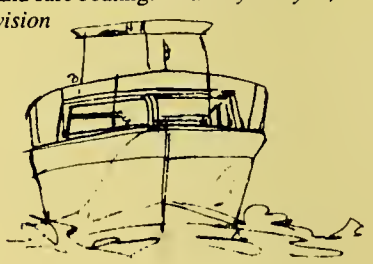
11. A courteous boater:
    (a) slows down and watches his wake when approaching congested areas or small boats with low transoms.
    (b) asks for owner permission to launch or moor a boat on private property.
    (c) doesn't litter.
    (d) is aware that sound can travel far on water and keeps music and other noise to a minimum.
    (e) all of the above.
12. On what date do boat registration decals expire?
    (a) April 30
    (b) June 30
    (c) Oct. 31
    (d) Dec. 31
13. The one type of PFD specifically designed to turn an unconscious person from a downward position to a vertical or slightly backward position and keep the wearer's face out of the water is:
    (a) I
    (b) II
    (c) III
    (d) IV
14. T or F Standing in a small fishing boat with a PFD on is an acceptable, safe practice.
15. T or F Alcohol is involved in over 50% of the drownings which occur in the United States.
16. T or F The best way to test a fire extinguisher is by spraying a small amount of the agent toward the ground.
17. T or F Most ski belts are Coast Guard-approved flotation devices.
18. T or F "Stressors" commonly affecting helmsmen make drinking alcohol while operating a boat equally as dangerous as drinking and driving a car.

ANSWERS

1. (c) Also, boat registration figures should read from left to right, be at least three inches high, be of contrasting color to the background, and be as high above the waterline as practical.
2. (b) The "observer" must be present to watch and pass the skier's signals on to the operator.
3. (b) To avoid the danger of the person overboard coming in contact with the propeller, it's always best to stop the motor.
4. (b) The shore is usually farther than it appears, so if the boat is not in danger, it's best to hold on to it. Clothing can preserve body heat and help you float—remove clothing only if it hampers movement.
5. (b) Wind from the boat's motion fans the flames.
6. (c) Drowsiness or inability to get up after a rest are symptoms of hypothermia.
7. (c) Alcohol or massaging of limbs may result in an abrupt drop in the critical core body temperature and lessen the chance for survival.
8. (b) All boats *may* be registered, but all motorized boats *must* be registered regardless of their length or size of motor.
9. (d) In addition, there must be one U.S. Coast Guard-approved PFD, in good and serviceable condition, for each person on board.
10. (e) A boater should always be aware of weather conditions and know how to identify and avoid an approaching storm. Indicators to watch for are dark clouds, shifts in wind direction and speed, and a drop in barometric pressure. Always check radio or television weather broadcasts before going out.
11. (e) Courteous boaters make the best skippers and they know the rules of the water.
12. (d) The expiration date was changed from April 30 to Dec. 31 effective this year. New decals are required annually. Boat owners who have not yet registered their craft and obtained new decals will need to visit their county assessor's office for assessment and then the county treasurer's office to purchase decals.
13. (a) Type II is similar to Type I. However, Type II is designed only to keep a person's head and shoulders above water, not necessarily his face.
14. (F) Standing in a small boat is never a good idea—PFD or not.
15. (T) Each year, boating accidents claim over 1,200 lives and injure thousands more. Waterways are second only to highways as the scene of the most accidental deaths in this country. The Coast Guard, Congress, and state law enforcement officials recognize alcohol as a significant problem on the water.
16. (F) Fire extinguishers should be checked by a professional. By releasing even a small amount, the valves may not reseal and a gradual discharge may result.
17. (F) Ski belts are not Coast Guard approved because they do not assure upper body support and may become loose or shift position on the body.
18. (T) Research shows that exposure to "stressors"—such as sun, glare, wind, and other motion on the water—produces a kind of "boater's hypnosis" or fatigue which slows reaction time almost as much as if you were legally drunk. Drinking alcohol while boating intensifies the effects of stressors, so each drink increases the risk of accidents.

How did you do? If you scored over 15, you have a good chance of staying afloat. If you scored below 15, you may be on a sinking ship. But no matter how you scored, if you desire more information or have questions on laws, requirements, or boating etiquette, contact any Department of Fish, Wildlife and Parks office.

Happy and safe boating!—*Tammy L. Ryan, Parks Division*



The Bird's-Eye View of Lewis and Clark

KRISTI DUBOIS

Bald eagle

by Ken Walcheck

The 1804-06 expedition of Meriwether Lewis and William Clark is a classic in the vast literature of discovery and exploration. But the full scope of its scientific accomplishments—such as the zoological contributions—never has been fully appreciated. The primary objective of the expedition was to explore the Missouri and other western rivers in the hope of finding "the most direct and practicable water communication across the continent for purposes of commerce."

In his detailed letter of instruction to Lewis, President Thomas Jefferson directed observation of "the animals of the country generally, and especially those not known in the U.S. the remains and accounts of any which may [be] rare or extinct." From a diverse and complex array of assignments emerged an incredible accumulation of scientific information.

A look at Reuben Gold Thwaites' "Original Journals of the Lewis and Clark Expedition, 1804-1806" clearly shows that Lewis took incredible pains to record as much information as circumstances permitted. Considering the difficulties of travel and the problems of survival, it is difficult to imagine how he found time to document as much as he did. He stood between the traditions of earlier armchair naturalists and later academic specialists.

On April 27, 1805, when the Corps of Discovery entered what is now Montana, Lewis started what was to become Montana's first inventory of birds. Ever the conscientious journalist, Lewis wrote: "the Eagles, Magpies, and Gees have their nests in trees adjacent to each other; the magpy particularly appears fond of building near the Eagle, as we scarcely see an Eagle's nest unaccompanyed with two or three Magpies nests within a short distance. The bald Eagle are more abundant here than I ever observed them in any part of the country."

Largely because of Lewis' meticulous attention, the journals contain a wealth of information about winged creatures—ranging from a list of birds merely encountered to exceedingly detailed descriptions. Lewis had an eye for detail and a flair for recording what he saw. The on-the-scene reporter/naturalist was also blessed with curiosity and alertness, enabling him to capture what might have seemed of little importance to even a well-trained scientist. Many of Lewis' entries on birds are seasoned with supplementary notes on flight characteristics, food habits, songs, and behavioral traits of sufficient clarity and depth to allow ready identification of the species. I often wonder what additional feats Lewis could have accomplished if he would have had a pair of 35mm binoculars and a basic course in ornithology.

Consider for example, Lewis' attention to detail in describing the common poor-will:

Oct. 16, 1804 (vicinity of Emmonsburg, N.D.)

"This day took a small bird alive of the order of the [blank space in diary] or goatsuckers [poor-will]. it appeared to be passing into the dormant state. on the morning of the 18th the mercury was at 30a.° [Fahrenheit] the bird could scarcely move. I run my penknife into it's body under the wing and completely distroyed its lungs and heart yet it lived upwards of two hours this fanominon I could not account for unless it proceeded from the want of circulation of the blood."

The key words are, "it appeared to be passing into the dormant state." In 1949, 145 years after Lewis' observation, ornithologist E.C. Jaeger substantiated Lewis' theory about the poor-will's hibernation. Jaeger found that dormancy extended over a winter period of 85 days. The bird's temperature was taken on five different days, and it ranged from 64.4 °F to 67.6 °F (about 30 °F below normal), while the surrounding air temperature on the same days ranged from 63.5 °F to 75.3 °F.

Lewis' observations of nesting Canada geese on the Missouri River have especially noteworthy ornithological significance:

April 13, 1805 (vicinity of the Little Missouri River)

"This lake and its dicharge we call goos Egg from the circumstances of Capt. Clark shooting a goose while on her nest in the top of a lofty cottonwood tree, from which we afterwards took one egg. The wild gees frequently build their nests in this manner, at least we have already found several in trees, nor have we as yet seen any on the ground or sand bars where I had supposed from previous information that they most commonly deposited their eggs."

April 14, 1805 (Little Missouri River)

"Saw many gees feeding on the tender grass in the praries and several of their nests in trees; we have not in a single instance found the nest of this bird on or near the ground."

May 3, 1805 (near the mouth of the Poplar River)

"found the nest of the wild goose among some driftwood in the river from which we took three eggs. this is the only nest we have met with on driftwood, the usual position is the top of a broken tree, sometimes in the forks of a large tree, but almost invariably from 15 to 20 feet or upwards high."

Early scientists did not take Lewis' observations and documentation of tree-nesting geese seriously; they refused to believe that geese would use the abandoned nest of a raptor or a blue heron for nesting. Not surprisingly, the early ornithologists, pioneers in a new scientific discipline, were treated as second-rate scientists, not worthy of rank in the academic pecking order.

Lewis also documented one of the smaller races of migratory geese that pass through Montana. Currently, leading authorities recognize 11 North American races of Canada geese, ranging from the tiny, dark-colored three- to four-pound cackler of the Pacific Coast to the pale-colored giant Canada—which can weigh 18 pounds—of the prairies.

Consideration of race or subspecies was not a part of deliberation during the Lewis and Clark era because these taxonomic subdivisions had not yet been developed. Before examining Lewis' journal entry, we should know what a species is, and how it differs from a race.

Since Charles Darwin's publications more than a century ago, the species concept has undergone two fundamental changes. First, through evolution, one species arises from another pre-existing species. Therefore, animals related through evolutionary descent should show "family resemblances," and indeed they do. Second, a species is not

Confusion: Use of Common Names

During the Lewis and Clark era, much confusion in the discipline of natural history centered on the slowness of adapting to Carl von Linnaeus' system of binomial nomenclature developed in 1758. The Linnaean classification still serves as the basic system for naming all plants and animals.

Linnaeus realized that common or colloquial names were unreliable for permanent classification. Most plants and animals in a given area have serviceable common names, but these names often vary within even a small region, to say nothing of when the ranges extend across linguistic boundaries. The passage of time presents additional problems with common names.

To avoid these difficulties, Linnaeus gave each plant or animal two Latin names, a generic name and a specific name—genus and species. The American robin, for example, is named *Turdus migratorius*, which means "thrush which migrates." Linnaeus also developed the means for providing "compartments" for cataloguing larger, more inclusive, categories of plants and animals: Kingdom, Phylum, Class, Order, and Family.

Linnaeus' system of cataloguing the products of nature laid the proper groundwork for taxonomists who would follow in his footsteps. Today, the "American Ornithologists' Union (AOU) Check List of North American Birds" provides professionals as well as laymen with detailed information on proper taxonomic classification (including common names) and ranges of all birds found north of the Mexican border. It is the official "bible" in determining whom is credited with discovery honors.

ALAN NELSON

American goldfinch

Personal Reflections

Several years ago, I was listening to a Regina radio talk show while returning from a fishing trip in northern Saskatchewan. The topic was "famous people you would like to visit with for 30 minutes if you could step back into the pages of history." As I listened to others visit with the radio announcer about their selection and what they would like to talk about, I thought about my own choice, had I such an opportunity.

I would welcome the opportunity to visit with Meriwether Lewis. However, it would be hard for me to limit my questions to a brief half hour. I would want to tell him the true merits of his accomplishments and how his detailed biological descriptions stimulated future studies in such diverse areas as ecology, taxonomy, and plant and animal physiology and phenology. I would also elaborate on how his finely honed art of observation and note-taking paved the way for those who followed him in natural history.

I would also emphasize that the Corps of Discovery fired a national spirit of adventure and zest which still lingers. Today's outdoor adventures continue to be an important part of the way we find out who we are; they provide opportunities for us to see, feel, and explore dimensions not yet mapped.

I think he would have welcomed such remarks.

HARRY ENGELS

Canada geese

described as an organism with a precisely defined shape, size, and color. Instead, it is defined as a living population, with *about* the same structure, size, color, behavior, and habitat, and breeding with each other rather than with members of other similar groups.

Species—the kind of animal—is usually the smallest unit recognized in zoological fieldwork. But specialists working closely with many individuals of the same species from different parts of the species' range often can sort them into geographic groups—eastern, western, southern, desert, coastal —and designate them as geographic races. These races may differ only in superficial characteristics—such as size or intensity of color—but are still capable of interbreeding with each other. To non-scientists, the minor distinctions that separate races are usually not very significant.

After carefully reviewing Lewis' entry, I have little doubt that he observed a smaller race of Canada geese:

May 5, 1805 (between Poplar and Milk rivers on the Missouri)

"saw a great number of white brant also the common brown brant, geese of the common kind and a small species of geese which differ considerably from the common canadian goose; their neck head and beak are considerably thicker shorter and larger than the other in proportion to it's size, they are also more than a third smaller, and their note more like that of the brant or a young goose which has not perfectly acquired his notes, in all other rispects they are the same in colour habits and the number of feathers in the tale, they frequently also ascociate with the large geese when in flocks, but never saw them pared off with the larger or common goose."

Looking at the specific location, time of year, and present migratory patterns of the various races of Canada geese that pass through eastern Montana, the lesser Canada goose (*Branta canadensis parvipes*) could well be the race Lewis described.

It is unlikely that he saw brown brant, since both brant species (black and Atlantic) are almost exclusively coastal; large flocks have never been observed in the interior of North America. The "white brant" that Lewis refers to is undoubtedly the snow goose (*Chen caerulescens hyperborea*).

Lewis was also one of the earliest to observe that birds show a surprising variety of adaptations to cope with their physical surroundings.

Examine, for example, his astute observations and notes on the adaptations of sharp-tailed grouse for moving about on snow: "the toes are also curiously bordered on their lower edges with narrow hard scales which are placed very close to each other and extend horizontally about 1/8 of an inch on either side of the toes thus adding to the width of the tread which nature seems boutifully to have furnished them at this season for passing over the snow with more ease. in the summer season those scales fall off."

How right he was! Several grouse species solve the problem of locomotion on snow by growing fringelike scales along the side of each toe. In spring, these "snowshoe" fringes are molted.

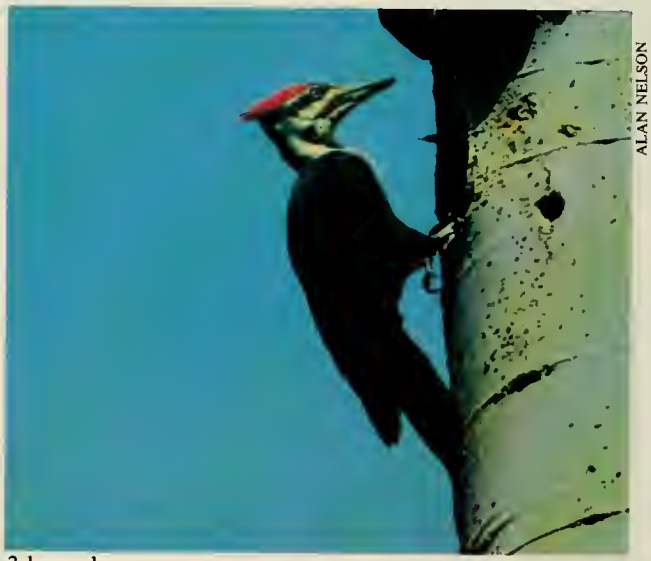
Lewis was quick to observe another specialized adaptation —woodpeckers' tail feathers have extra-sturdy shafts that help support the birds while they climb trees. When describing the "black woodpecker" (Lewis' woodpecker), he wrote, "the pointed tail seems to assist it in setting with more eas[e] or

What Is Bigger Thar

The following quiz illustrates how common names used by Meriwether Lewis a century and a half ago can be confusing when trying to identify birds today.

Match the common names used by Lewis (under the photos) with the common names used today (below), as appearing in the "American Ornithologists' Union Check List of North American Birds," 6th edition, 1983. The answers appear at the end of the quiz.

Common Names
a. mallard
b. sharp-tailed grouse
c. avocet
d. bufflehead
e. brown-headed cowbird
f. eastern kingbird
g. northern flicker
h. Lewis' woodpecker
i. snow goose
j. pileated woodpecker


ALAN NELSON

3.logcock

ALAN NELSON

1.bee-martin

TOM J. ULRICH

4.buffalo-pecker

MIKE LOGAN

2.prairie hen with pointed tail

JAN L. WASSINK

5.lark-woodpecker

a "Butterbox"?

JAN L. WASSINK

6.butterbox

JAN L. WASSINK

7.duckanmallard

MIKE LOGAN

8.white brant

ALAN NELSON

9.black woodpecker

PETE & ALICE BENGEYFIELD

10.Missouri plover

Answers
1.(f)
2.(b)
3.(j)
4.(e)
5.(g)
6.(d)
7.(a)
8.(i)
9.(h)
10.(c)

retaining its resting position against the perpendicular side of a tree."

We now know there are probably almost as many feeding adaptations, structural and functional, as there are species of birds. Lewis repeatedly pointed out that birds exhibit numerous adaptations and refinements that support their special needs. On May 1, 1805, about 75 miles above the mouth of the Yellowstone River, Lewis wrote a very detailed description of the American avocet, which he called the "Missouri plover or pleaver," or the "party coloured plover": "...the beak is black and flat, largest where it joins the head, and from thence becoming thiner and tapering to a very sharp point, the upper chap being 1/8 of an inch the longest turns down at the point and forms a little hook...; the beak is much curved, the curvature being upwards instead of downwards as is common with most birds; the substance of the beak precisely resembles whalebone at a little distance, and is quite as flexible as is that substance...this bird which I shall hence forth stile the Missouri plover, generally feeds about the shallow bars of the river, to collect its food which consists of [blank space in manuscript], it immerces it's beak in the water and throws its head and beak from side to side at every step it takes."

Lewis clearly explained how the avocet uses its recurved bill in obtaining food. Avocets often feed in groups, marching shoulder to shoulder through shallow waters, searching for small aquatic animals, swinging their cinnamon heads with upturned bills sideways like farmers scything hay. Birds with a straight or a downward-curved bill could not feed in this way.

Lewis recorded a probable 54 species of birds in Montana. This represents 14% of the 374 birds currently listed in the state's official check list. Discoveries new to science documented in Montana included the lesser Canada goose, sage and blue grouse, long-billed curlew, Clark's nutcracker, Lewis' woodpecker, pinyon jay, and western meadowlark.

Lewis and Clark should have been credited with discovery of additional birds new to science and documented for the first time. Why wasn't proper credit given? As reported by Paul Russell Cutright, one of the most knowledgeable authorities on the Lewis and Clark expedition, their priceless journals were deposited with the Philosophical Society in Philadelphia in 1814, after Nicholas Biddle's abbreviated paraphrase of the narratives. They collected dust for three-quarters of a century before they were finally resurrected by noted ornithologist Elliott Coues. During this time, other scientists took credit for some of Lewis' discoveries.

Other reasons include: (a) some species were inadequately described for positive identification, nor was there a preserved specimen to prove the actual sighting (Lewis attempted to collect as many specimens as possible, but inadequate preparation, preservation, and methods of transportation destroyed many of them), and (b) Lewis was not trained in using the Latin binomial system for classifying plants and animals developed by Carl von Linnaeus. Briefly, every known species is given a Latin name—its genus and species—that can be understood worldwide (see sidebar). Lewis' utilization of Latin in the journals was minimal and he utilized only the genus portion of the binomial in describing some species. He also used a colorful selection of common names not used today which presents additional difficulty for someone trying to identify a species mentioned in the journals.

For example, on the return trek through Montana (July 2, 1806), Lewis supplemented his journal entry with notes about birds observed in the Missoula area: "the dove [mourning dove], the black woodpecker [Lewis' woodpecker], the lark woodpecker [northern flicker], the logcock [pileated woodpecker], the prairie lark [horned lark], sandhill crain [sandhill

MIKE GURNETT

White pelicans

Birds Observed by Lewis and Clark In Montana, 1805-1806

Species	Observation Dates[1]
American white pelican, *Pelecanus erythrorhynchos*	7/17/06; 8/5/06
Tundra (whistling) swan, *Cygnus columbianus*, or trumpeter swan, *Cygnus buccinator**	4/27/05; 5/3/05; 6/8/05; 7/21/05; 7/6/06
Canada goose, *Branta canadensis canadensis*	4/27, 28, 30/05; 5/3, 5, 23/05; 6/13, 14, 15/05; 7/21, 22, 23, 24, 25/05; 8/2, 3, 4, 5, 8, 9, 11/05; 7/11, 13, 19, 20, 23/06
Lesser Canada goose, *Branta canadensis parvipes*	5/5/05
Snow goose, *Chen caerulescens hyperborea*	5/5/05
Mallard, *Anas platyrhynchos*	7/27, 29/05; 8/2/05
Wood duck, *Aix sponsa*	6/19/05; 7/29/05
Common merganser, *Mergus merganser*	6/21/05; 7/20, 24/05; 8/2/05
Turkey vulture, *Cathartes aura*	6/5/05
Golden eagle, *Aquila chrysaetos*	7/11/05; 8/3/06
Bald eagle, *Haliaeetus leucocephalus*	4/27/05; 5/7, 8/05; 8/9/05; 8/3/06
Osprey, *Pandion haliaetus*	8/10/05
Blue grouse, *Dendragapus obscurus*	7/21/05; 8/1/05
Ruffed grouse, *Bonasa umbellus;* spruce grouse, *Dendragapus canadensis;* or blue grouse**	8/1/05; 9/6, 7, 10, 12, 13/05; 6/26/06
Sharp-tailed grouse; *Pedioecetes phasianellus*	5/21, 22/05; 9/8, 9/05; 7/1, 2/06; 8/5/06
Sage grouse, *Centrocercus urophasianus*	6/5/05; 8/12/05
Sandhill crane, *Grus canadensis*	7/21, 22, 23, 24, 29/05; 8/4, 8/05; 9/7/05; 7/2, 11/06
Mountain plover, *Charadrius montanus*, or upland plover, *Bartramia longicauda**	7/22/05; 7/2/06
Long-billed curlew, *Numenius americanus*	6/4, 22/05; 7/13, 24/05; 8/3/05; 7/2, 6/06
Eskimo curlew, *Numenius borealis*, or whimbrel, *Numenius phaeopus**	6/4/05
Willet, *Catoptrophorus semipalmatus*	5/9/05
American avocet, *Recurvirostra americana*	5/1/05; 7/17/06
Mourning dove, *Zenaidura macroura*	6/8/05; 7/13/05; 7/2, 6, 11, 19/06
Passenger pigeon, *Ectopistes migratorius*	7/12, 13/05; 7/5, 12, 19, 21, 23, 24, 25/06
Black-billed cuckoo, *Coccyzus erythropthalmus*	7/16/06
Great horned owl, *Bubo virginianus*	5/20/05
Common poor-will, *Phalaenoptilus nuttallii*	5/17/05; 8/4/06
Common nighthawk, *Chordeiles minor*	6/30/05
Belted kingfisher, *Megaceryle alcyon*	5/17/05; 7/12, 29/05
Northern flicker, *Colaptes auratus*	7/2/06
Pileated woodpecker, *Dryocopus pileatus*	9/9/05; 7/2/06
Red-headed woodpecker, *Melanerpes erythrocephalus*	5/28/05; 9/9/05; 7/2, 16/06; 8/3/06
Lewis' woodpecker, *Melanerpes lewis*	7/20/05; 8/2/05; 7/2/06
Hairy woodpecker, *Picoides villosus*, or downy woodpecker, *Picoides pubescens**	5/28/05
Eastern kingbird, *Tyrannus tyrannus*	6/10/05; 7/2, 6/06
Horned lark, *Eremophila alpestris*	7/2/06
Cliff swallow, *Hirundo pyrrhonota*	5/31/05; 6/12/05; 7/27/05; 7/23/06
Black-billed magpie, *Pica pica*	4/27/05; 8/3/06
Common raven, *Corvus corax*	7/2, 6, 19, 23/06
American crow, *Corvus brachyrhynchos*	4/30/05; 6/15/05; 7/13, 18, 23/06
Pinyon jay, *Gymnorhinus cyanocephalus*	8/1/05
House wren, *Troglodytes aedon* **	6/8/05
American robin, *Turdus migratorius*	6/8/05; 7/2/06
Brown thrasher, *Toxostoma rufum*	5/18/05; 6/8/05
Mountain bluebird, *Sialia currucoides*	6/10/05
Loggerhead shrike, *Lanius ludovicianus*	6/10/05
Western meadowlark, *Sturnella neglecta*	6/22/05; 7/2/06
Brewer's blackbird, *Euphagus cyanocephalus*	6/8, 15, 25/05
Brown-headed cowbird, *Molothrus ater*	7/11/05; 7/2, 11/06
American goldfinch, *Carduelis tristis*	6/8/05
McCown's longspur, *Calcarius mccownii**	6/4, 23/05
Chestnut-collared longspur, *Calcarius ornatus**	6/4/05

[1] Data from Thwaites, Reuben Gold, ed., "*Original Journals of the Lewis and Clark Expedition, 1804-06,*" (eight volumes), Dodd, Mead and Co., N.Y., 1904-05.

* Sufficient data lacking to determine which species was observed.

** The absence of any description whatsoever makes it impossible to confirm if the species was actually observed, or, if observed, no description of the species is given that provides a basis for identification.

crane], prarie hen with the short and pointed tail [sharp-tailed grouse], the robin [American robin], a species of brown plover [mountain plover?], a few curloos [long-billed curlew], small black birds [Brewer's blackbird?], ravens [common raven], hawks [?] and a variety of sparrows [?] as well as the bee martin [eastern kingbird] and the several species of Corvus genus [magpie, Clark's nutcracker, Steller's jay??] are found in this valley."

Mention of pheasants in the journals will also confuse some readers because the ringneck was not introduced into Montana until the 1890s. However, pheasants had been introduced into the United States at some private estates in the East before the Lewis and Clark expedition. Since both explorers were probably familiar with them, it was only natural for them to identify mountain grouse as pheasants.

If Lewis were to follow the same route through Montana today, he would see some differences. Because of natural geological changes, shifting climates, and changing vegetation, some of the avian residents are different. But the environmental force with the harshest and most far-reaching impact on the ecology of birds along the expedition's route is that of man. The modifications of an encroaching civilization since the expedition's trek have been powerful and pervasive. In terms of wildlife habitat modification and reduction—and in terms of the bright tapestry of bird species, distribution patterns, and numbers—Montana has fared better than most states through which the explorers journeyed.

Today, Lewis would also see some species not present in Montana during 1805-06. Successful upland game bird introductions include the ring-necked pheasant, gray partridge, chukar, and Merriam's turkey. Prairie chickens probably arrived in Montana about 1900, peaked between 1900-30, declined drastically during the 1930s and disappeared in the early 1940s (see "The Start of a Silence," *Montana Outdoors*, March/April 1980).

Man's interference with the environment also encouraged the spread of some exotic species such as the starling, house sparrow, rock dove, and mute swan. It has also encouraged increased numbers of some native species such as the Canada goose, American robin, mourning dove, and barn swallow.

Lewis would not see the now-extinct passenger pigeon which he recorded on seven different occasions in Montana, nor would he see the nearly extinct Eskimo curlew. Sightings of bald eagles, peregrine falcons, mountain bluebirds, and long-billed curlews would also be down considerably.

Consider the ingenuity and resourcefulness required on this epic journey in a strange and hostile country. Many travel miles were won only by prodigious labor and many physical discomforts, all of which made it difficult to observe and record wildlife. Portaging over sagebrush plains laced with pads of prickly pear cactus, pushing up rugged mountain slopes, pulling canoes and pirogues upstream through icy waters, trekking through dense forest choked with deadfall timber, coping with sickness and continuous aches and pains, driving rain, raging winds, bitter cold, baking sun—it is truly remarkable that Lewis' notes on birds are as copious and complete as they are.

There is absolutely no doubt in my mind that the difficulties of the trip played an important role in determining what and how much was recorded for specific areas. This is perhaps best shown by comparing the results of a nesting bird ecology study I conducted in the Missouri River "breaks" during 1967-68. I recorded 95 bird species in the study area (45 river miles). Lewis recorded only the cliff swallow and a "small white and black woodpecker with a red head" for the same stretch of river in which the study was conducted.

Here's what Lewis wrote about the exhausting work involved in going up the Missouri River above Pablo Island in this specific reach of the Missouri: "the men are compelled to be in the water even to their armpits, and the water is yet very could, and so frequent are those point(s) that they are one fourth of their time in the water, added to this the banks and bluffs along which they are obliged to pass are so slippery and the mud so tenacious that they are unable to wear their mockersons, and in that situation draging the heaving burthen of a canoe and walking acasionally for several hundred yards over the sharp fragments of rocks which tumble from the clifts and garnish the borders of the river; in short their labour is incredibly painfull and great."

Under such conditions, the No. 1 priority might not be writing copious notes on birds.■

Lewis' "Cock of the Plains"

The Corps of Discovery's mapmaker and artist, William Clark, sketched the "Cock of the Plains" (sage grouse), discovered by Meriwether Lewis in the vicinity of the Marias River. Lewis' journal entry for March 2, 1806, provides a detailed description of the bird, including a note on palatability: "...the flesh of the cock of the Plains is dark, and only tolerable in point of flavor...."

The sketch reproduced here is from Reuben Gold Thwaites' "Original Journals of the Lewis and Clark Expedition, 1804-06," (eight volumes), Dodd, Mead and Co., N.Y., 1904-05.

READERS RESPOND

Wanted: Black Bear Stories

I am involved in a wildlife production for television about the black bear. I also intend to publish a book about the black bear, a book in which I will try to bring this most interesting mammal out from the shadow of publicity cast by its larger relative, the grizzly bear.

I would like to ask the help of your readers in conducting my research. In addition to scientific and biological information about the black bear, I would like to include personal stories and anecdotes about black bears from people who live, work, and play in the outdoors.

Personal accounts of animal behavior are always interesting and often provide the clearest picture of an animal's true character. If your readers have had any interesting encounters with black bears or have observed bears engaged in amusing or unusual activity, I would very much like to hear their stories. Their help will be an invaluable asset in shedding a more realistic light on the black bear.—*Greg Hood, P.O. Box 5862; Helena, MT 59601*

• *Here's one from long-time* Montana Outdoors *subscriber Elma K. Davis of Leonardville, Kan., to get you started.*—Ed.

Sic 'em, Mom

Several years ago, my mom took a job as housekeeper for the manager of the power plant at Mystic Lake. She loves to go out in the timber with a lady friend of hers and pick huckleberries and other wild fruits.

It was a beautiful fall day and the huckleberries were ripe and plentiful. The girls took their berry buckets and hiked to a big berry thicket about a mile or so from camp. They became interested in seeing how fast they could fill their buckets, and they didn't think to check to see if they had company.

Mom had picked all the big berries from one side of the thicket and started to go around to the other side. A big black bear was picking berries on the other side; evidently, he had decided to investigate her side of the bush at the same time. Anyway, they met, face to face. There was hardly more than a foot or so between them. Mom dropped her bucket and screamed, and at the same time, struck the bear in the face with her hands. That poor bear! He took a big jump away from her and fairly flew down the mountainside. He didn't even look back. Anyone who has ever heard my mother scream would feel wholehearted sympathy for the bear.

They measured how far he had jumped before he lit and started to run—10 feet. Mom took a lot of ribbing about it. After that, whenever she and her friend went berry picking, they always checked to make sure there was no company on the other side of the bush.

Friends Everlasting of Whitefish (FEW)

Every time I hear or read a put-down of whitefish, I have the inner feeling, "They know not what they say." The whitefish needs no defense.

The whitefish is primarily a cold-water fish. When the trout go dormant in the cold water, that's when whitefish are most active. This is generally the time of year when the rich and elderly head for warmer climates. This leaves the whitefisherman in a paradise of his own. For this we are grateful, but in reality there are more fish than we can take care of.

The limit of 100 per day in many areas speaks for itself. We don't have to depend on the Fish and Game Commission spending millions of dollars to stock our favorite streams.

In my judgment, whitefish are more flavorful—fried, smoked, or any other way you want to fix them—than most trout. Pound for pound on the same tackle, they are just as aggressive as trout, and when they are schooled up, there is constant action. You don't have time to get cold.

What I like most about whitefishing is the miles of river without a track in the snow except my own, or those of a duck hunter or trapper. Fish lying in the snow remain clean, cold, and firm; there are no mosquitoes or flies. And you very seldom sweat. The tackle is limited—hooks, sinker, and some hellgrammites.

We in the Gallatin Valley are blessed with good whitefish streams. In some places, the fish average nearly two pounds, up to three, and there's an unlimited supply.

The whitefish needs no defense, just a little understanding.—*Harold L. "Barney" Barner; Belgrade, Mont.*

Refunding Treasure

• *The following letter and a big game drawing refund check for $50 (with a 1979 date on it) were sent to Department of Fish, Wildlife and Parks Director Jim Flynn. We thought our readers would also enjoy reading Mr. Marlen's words.*—Ed.

Once again you receive a letter from a hunter who wishes to cash his big game refund check. Of course the check is outdated and void. Now just so you will keep reading this letter, I will tell you I have no interest in the $50. I consider the money a donation to the Montana Department of Fish, Wildlife and Parks.

What I thought I would do is tell you a story about one young man who grew up hunting in Montana. I would say this is not so much a story, but more a memory.

Can you remember what you were doing in 1979? It's hard for me to believe, but I was getting ready to start my sophomore year in high school. I had no idea that after shooting a six-point elk, antelope, and black bear in junior high, I would be hunting in the Bitterroot on Sept. 29, 1979, for mountain goats. I shot one that day. It brings back so many happy memories.

My parents said they found the enclosed check this summer (1986). They gave it to me tonight saying, "Why don't you write them? It's fifty bucks, and it's worth trying." I'm getting married tomorrow, and I guess they feel I need every penny I can lay my hands on; so I sat down to write a letter to the state auditor and ended up writing you instead.

I already told you how I feel about the money, and I guess this check could almost be a collector's item. Heck, you still called yourselves "The Department of Fish and Game."

But the real reason I wrote is to thank you and the rest of the people who work so hard in the department for the special moments I have spent hunting in Montana. It wouldn't have been possible without you!

So on those days when all hell breaks loose and you don't know why you ever started this job, just remember there are a lot of people out here who really care and depend on you very much. I'm trusting you to keep our Montana the way it has been, because I dream of my son enjoying the treasures of Montana as much as I did. —*Charles Marlen, Jr.; Grand Forks, N.D.*

An Eye for Detail

I enjoyed "The Preachings of an Old Hunter" in the Nov./Dec. 1986 issue.

The drawing of "Gramps" himself is very good. However, some of the detail is far from even reasonable.

According to the story, those indefinite objects he is carrying should be squirrels. They look more like ducks or doves than squirrels.

His rifle (it *could* be a Marlin) would not have had a sling. A real hunter did not have a sling in those days. If he did, the end of the sling (strap) would not be fastened loosely around the bare iron of the barrel.

These boo-boos by the artist spoil the picture, in my opinion. I just wanted you to know that one of your readers has an eye for detail.—*R.G. Perry; Newport, Vt.*

NONGAME NEWS

THE GREAT GRAY GHOST

Hikers in the mature forests of Montana, particularly in the northern and western parts of the state, might occasionally find themselves face to face with a large gray apparition, staring at them from a trailside branch. If the "ghost" has bright yellow eyes, large facial discs, dusky gray feathers, no visible ear tufts, and seems huge, chances are, they're looking at one of Montana's most interesting birds, the great gray owl.

This is the largest owl species in North America—28 inches tall, with a wingspan of almost five feet. Its dense plumage makes it look deceptively large, although at over two pounds it is still heavier than all except the most northerly races of great horned owl. Great grays can be distinguished from the much smaller barred owl (whose distribution is spreading in northwestern Montana) by their yellow eyes, grayer plumage, and size. The call of the great gray is a series of deep booming "WHOOs," each lower in pitch.

Great gray owls are found across northern North America, from the boreal forest in Alaska, east to Ontario, and south to the Sierra Nevadas in California; in Idaho, Montana, and Wyoming; and east to Minnesota, with sporadic winter records south and east to Michigan, Massachusetts, and New York.

Breeding habitat is heavily timbered mature lodgepole pine, ponderosa pine, or other conifer types interspersed with aspen and wet meadows. More open habitats are frequented during winter. In Montana, this owl is listed as a species of special concern, based on its undetermined population status, its vulnerability to habitat disturbance, and the potential adverse effects of land use practices on its primary habitat (mature or old-growth forests). Great gray owls have been recorded in 16 latilong blocks in the state, mostly west of the Continental Divide, and they have been found breeding in the northwestern and southwestern corners of the state.

Great grays nest in the abandoned nests of other species, such as goshawks or red-tailed hawks, sometimes as low as 12 feet but usually 50 to 100 feet above the ground. There is little information on the nesting cycle, but the female lays two to five (usually three) eggs in early April and incubates them for 28 to 30 days, during which the male does all the hunting. He hunts mostly from a perch on the edge of openings.

The owls are crepuscular—they are most active at dawn and dusk. Once the young hatch, in May, they depend on the adults for food for six to eight weeks; they generally stay in the nest tree. Primary food of great gray owls includes rats, mice, squirrels, voles, and other small rodents, although they also feed on small birds and grouse to some extent. There is some indication that populations fluctuate in response to rodent abundance. Although they are primarily year-round residents in most of their range, they also react to prey availability by wandering outside their normal range during harsh winters.

They are quite tame and can be easily approached. While the chance of finding this "ghostly" species may be low in much of its densely timbered range, it's also likely you'll get an excellent look if and when you do. The Department of Fish, Wildlife and Parks is interested in sightings of this or any other species of special concern.—*Daniel Casey, wildlife biologist, Kalispell*

CREEPY-CRAWLYS?

Attorneys probably have an appropriate 50-cent word to describe the injustice heaped on two of our state's inhabitants. "Slander" or "defamation of character" are terms that come to mind. Just mention the word *"s-n-a-k-e"* and a fair number of people shiver, grimace, or speak unkind words. Misconceptions and a lack of knowledge have resulted in snakes being known as frightening, dangerous creatures. The rubber boa and the plains hognose snake have suffered these injustices, along with other species.

They say you shouldn't be judged by your relatives, but since the rubber boa is in the same family with the powerful boa constrictor and the lengthy reticulated python, the rubber boa is probably viewed with some degree of unease. In fact, the rubber boa is an inoffensive member of the boa family and seldom, if ever, bites

DAVE BOOKS

Great gray owl

when threatened. An inhabitant of western Montana, the rubber boa may be fairly common; however, its drab color and crepuscular nature (active at only dusk and dawn) probably account for the lack of sightings.

A stout, muscular body with a short tail shaped like its head has given the rubber boa another moniker, "the two-headed snake." Its name comes from its plain, brown back, which looks like rubber and is covered with small, smooth scales. The yellowish color on its belly is also an identifying field characteristic. Rubber boas, seldom more than three feet long, are adept burrowers, but are also capable swimmers and tree climbers. They eat insects, small birds, lizards, rodents, and other snakes. Their prey is generally grabbed behind the head and then suffocated by "constriction."

Snakes evolved from lizards, and the boas are considered primitive. The rubber boa has small, clawlike structures on each side of the vent or anus, believed to represent remnant hind limbs.

Rubber boas prefer moist sites within pine and fir forests. Look for them along streams, and under logs and rocks. They have been found from sea level to as high as 10,000 feet. They are well adapted to Montana and remain active at low temperatures that would immobilize other snakes. Body temperatures of 54°F have been reported. They probably survive winter by burrowing underground, but biologists know little about their hibernation. In late August or September, females bear from two to eight live young.

The plains hognose snake is another unjustly accused eastern Montana resident. In its case, first impressions based on appearance and action can easily lead to false assumptions. The plains hognose has a sharply pointed head with a turned-up snout and dark blotches along its body, characteristics similar to some of its venomous relatives. To make matters worse, when threatened the plains hognose puts on such an aggressive display it has been nicknamed the "puff adder." When confronted, it flattens its head and neck, much like the poisonous adders, and hisses or blows loudly while repeatedly striking out. If the attacker persists, the snake puts on quite a show. It will act as if severely injured; its mouth falls open and the body convulses. The death scene continues as the snake turns on its back and lies perfectly still. This lifeless act is flawless, until you flip it over onto its belly. The snake will then roll itself onto its back. This flip-flop game will continue as long as you want to play.

Quite a bluffer, the plains hognose snake seldom bites and is not dangerous. That is, unless you're a toad. Toads are its main food, and the plains hognose has specialized adaptations to utilize this food source. Two enlarged fanglike teeth at the rear of the upper jaw puncture and deflate toads, which defensively blow themselves up when attacked. These fanglike teeth also inject poisons fatal to toads. The plains hognose snake also has an enlarged adrenal gland which produces enough adrenalin to neutralize the action of the poisons secreted by the toad's skin.

Because of its limited distribution, the plains hognose is listed as a species of special concern in Montana. Its occurrence has been verified only in a few areas in the eastern part of the state. The snakes are found in sandy or gravelly soils on the prairie and on river floodplains. They are secretive and usually active only in the morning or late afternoon. They mate in March and April, and from seven to 39 eggs are laid in loamy or sandy soil in June or July. Eggs hatch in two or three months. No information is available about its winter hibernation, but it probably burrows into loose soil, or dens in cavities.

Let's give these critters a break—no more libelous, uninformed name-calling. Besides, who can afford a lawsuit these days? Enjoy seeing them in the wild, and remember, we would appreciate hearing about it any time you happen to see these interesting species.—*Marilyn Wood, wildlife biologist, Kalispell*

GOOD READING

Snake River Birds of Prey, produced by the Bureau of Land Management (BLM), Idaho Power Co., and Idaho Department of Fish and Game. Available from BLM, Boise District Office, 3948 Development Ave.; Boise, ID 83705, 52 pages, free. Well-illustrated, beautifully presented summary of most of the raptors in Montana and Idaho.

Vertebrate Species of Special Concern, prepared by Dennis L. Flath, nongame biologist, Montana Department of Fish, Wildlife and Parks, June 1984.

Amphibians and Reptiles of Western North America, by Robert Stebbins, McGraw-Hill, New York, 1954.

Snakes of the American West, by Charles E. Shaw and Sheldon Campbell, Alfred A. Knopf, Inc., New York, 1974.

Living Reptiles of the World, by Karl T. Schmidt and Robert F. Inger, Doubleday and Co., Inc., New York, 1957.

Reptiles of North America, by Raymond Ditmars, Doubleday and Co., Inc., New York, 1936.

A REMINDER

Tax year 1986 is the fourth year that Montana taxpayers have been able to show their concern for the more than 500 species of nongame birds, mammals, reptiles, and amphibians by donating money through a checkoff on their tax forms.

As reported in an earlier "Nongame News" article, Montanans have contributed at a rate comparable to the average for all states with similar programs. These contributions are an extremely important part of the funding which keeps the Montana Nongame Program running.

For 1986, taxpayers once again may donate $2, $5, $10, or more, regardless of whether they're receiving a refund, by checking the appropriate box on the state income tax form.

We hope your accountant, a friend, or a news article has already reminded you to contribute to the perpetuation of the diverse wildlife resources of the state. If you have already done so, remind a friend to follow your example.

ALL BOOKED UP??

MO's binders will ensure less of a mess

Order yours today—just $6, prepaid, from MONTANA OUTDOORS, Department of Fish, Wildlife and Parks; Helena, MT 59620.

CONTRIBUTORS

• It's the opening day of elk season, an annual ritual. At daybreak on a familiar ridge, you are ready to hunt the dense timber at the edge of an equally familiar meadow. On the way up, you cross a road you've never seen before, and then you cross it again as it switchbacks up the slope with you. You are surprised by what you see: The dense timber is cut by a long, narrow swath, and you can't help wondering if you made a wrong turn. You could have been part of a scene such as this if you returned to hunt elk in the Clark Fork River drainage of west central Montana. In 1984, a powerline corridor and access road network were cut through forests along a 156-mile route from Garrison, Mont., to Taft, near the Idaho border. Turn to page 2 to find out how "Elk Under the Wire" are faring. **Mike Thompson**, a wildlife biologist based in Missoula, is working on a Bonneville Power Administration-funded elk study.

* * * * *

• "Looking Back," which illustrates Thompson's article, is an original serigraph by **Robert Spannring**, Livingston. It is available from The Wade Gallery, P.O. Box 1055, 116 N. Main; Livingston, MT 59047. Spannring's work is always an unusual and exciting addition to any issue, and this serigraph is no exception. Spannring has begun to focus on small showings, and his serigraphs, posters, oils, pastels, and pen and inks can be seen by scheduling a private showing through the above address.

* * * * *

• We all need it. But Montana's common loon population is the quintessential "Seeker of Solace." In addition to the loon's need for a quiet place in which to nest, it also: doesn't use lakes smaller than 10 acres (because it needs from 100 to 400 feet of open water on which to take off); avoids lakes at elevations of over 5,000 feet; and prefers to nest on shallow lakes, or at least lakes with shallow areas with high-density food sources for its chicks. Participants in the Montana Loon Study are trying to find out what kinds of disturbance and how much the loon can tolerate. As **Don Skaar** writes in his article, "The Montana Loon Study has tried to inform people that what loons need most is a little peace and quiet." Turn to his article on page 7. Skaar is a biologist with Trout Habitat Specialists in Bozeman, a consulting business specializing in maintaining and rehabilitating trout habitat. He has worked seasonally with the department and has been coordinator of the Montana Loon Study since 1983. He was one of the editors of the current (third) edition of "Montana Bird Distribution" (1985).

* * * * *

• If given a choice, we all have ideas about someone with whom we'd like to dine. Someone of whom we'd like to ask questions, and someone with whom we'd like to share bits of our own experience and knowledge. **Ken Walcheck** would choose Meriwether Lewis, and when you learn of the quality of Lewis' note-taking—more than 180 years ago, in the face of incredible difficulties of travel, to say nothing of the problems of survival—you, too, will marvel at how he found time to document as much as he did. As Walcheck writes, "He stood between the traditions of earlier armchair naturalists and later academic specialists." Join Walcheck for "The Bird's-Eye View of Lewis and Clark." Walcheck is the department's information officer for Region 7 (Miles City). His story and accompanying sidebars—including a quiz that will test your birdy knowledge—begin on page 15.

* * * * *

• This is the first time, but it won't be the last. We're referring to **Tom Palmer's** byline, and it appears with two features in this issue. Palmer gives you the scoop on the winner of Montana's second annual waterfowl stamp competition, Roger Cruwys. His entry, "Evening Arrival—Redheads" won first in a field of 58. For a look at Cruwys' entry, and those of seven finalists, turn to page 27. Palmer also continues *Montana Outdoors'* "Perspectives" series with a profile of Pat Barnes, a "living legend to a growing number of grown-up fly fishermen." In "Everyman's Old Man of the River," you learn of Barnes' involvement with the original clan of West Yellowstone river guides—and the fact that he and his wife, Sig, invented some essential flies, such as the goofus bug, the sofa pillow, and the H. & L. Variant. His name and that of the late Dan Bailey are intertwined by more than history and a love of fly-fishing. Turn to page 30 for Barnes' way of looking at fishing, a sentiment Mr. Bailey would heartily second: "The sport of fishing is seeing the problems you run into and somehow solving those problems." Palmer is a Helena-based technical writer for the department.

* * * * *

• It is far more than "The Search for Moby Pike." It is a summer science camp at Canyon Ferry Reservoir, and last summer it attracted 23 students. The students searched for the northern pike in Canyon Ferry because the toothy fish could threaten redevelopment of a successful trout fishery. They didn't find any pike (but they found lots of yellow perch, which should make perch fans smile). In addition, the students identified various species of algae, determined water chemistry, plotted temperature information, catalogued photos of the lake's microscopic life, analyzed the distribution of minnows, and much more. **Gil R. Alexander** and his wife Marilyn started the camp in 1983. Marilyn teaches chemistry at Capital High School, while Gil is chairman of the Science Department at Helena High School. Their story, for which he also took the photos, begins on page 32.

* * * * *

• When it comes to the Clark Fork, "Piscatorial Prophecies" are challenging—and controversial. As **Glenn Phillips** writes, "The distribution of brown trout in the upper Clark Fork River has probably received as much local attention as the state budget deficit....In the Clark's Fork case, the number of theories to explain fish distribution trends are nearly as numerous as the trout." Phillips proceeds to examine some of the theories and explanations to find out which hold water. Turn to his article on page 35. He is the department's pollution control biologist.

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• *MO* would like to thank the following photographers for their contributions to this issue: **Pete & Alice Bengeyfield**, Dillon; **Kristi DuBois**, **Alan Nelson**, **Conrad Rowe**, and **Cal Ryder**, Great Falls; **Harry Engels**, **Mike Gurnett**, **Mike Logan**, and **Dave Shors**, Helena; **Keith Szafranski**, Livingston; **Tom J. Ulrich**, West Glacier; and **Jan L. Wassink**, Kalispell.

CRUWYS' "REDHEADS" WINS

by Tom Palmer

Montana is not only blessed with one of the nation's most impressive wildlife resources, but it is also the home of some talented wildlife artists.

Joe Thornbrugh's dramatic "Canadas Over the Pintlers," winner of Montana's 1986 first-of-state waterfowl stamp contest, drew praise from collectors throughout the nation. And when the final accounting of the sales of that stamp and artwork are complete, approximately $350,000 will have been generated for enhancement and development of waterfowl habitat in Montana.

With Roger Cruwys' painting, "Evening Arrival—Redheads," winner in the second annual waterfowl stamp contest, Montana's waterfowl stamp is certain to generate continued interest among stamp collectors and waterfowl art enthusiasts.

As last year, the contest was open only to Montana artists who concentrated on painting a single theme. The theme of this year's contest was "Redheads," in honor of the 6,000 colorful bay ducks that breed in the intermountain marshes of Montana. Western Montana has long offered one of the few important redhead breeding grounds north of the Great Salt Lake.

Cruwys, of Bozeman, is no stranger to state conservation stamp competitions. He has been a finalist in waterfowl or trout stamp competitions in California, Nevada, Ohio, South Carolina, Pennsylvania, Kentucky, Illinois, and Oregon, as well as placing in the top 10% in the federal competitions entered. In 1984, the state of North Dakota commissioned Cruwys to paint its first-of-state trout/salmon stamp.

A native of upstate New York, Cruwys says his rural upbringing there led him to develop an early interest in nature and outdoor pursuits. Although a successful landscape architect/designer who received an undergraduate degree from Syracuse University and a master's from the University of California, he turned his attention toward sporting and wildlife art. "Basically, it was an itch that had to be scratched," he said.

"I had never achieved the top spot," Cruwys said shortly after winning the 1987 Montana waterfowl stamp contest. "I've come close so many times that I was getting bored and almost didn't enter. Yet I felt I had a reasonably good design

and colors to work with, so I thought I'd get it down and see what developed. It's nice to finally win one."

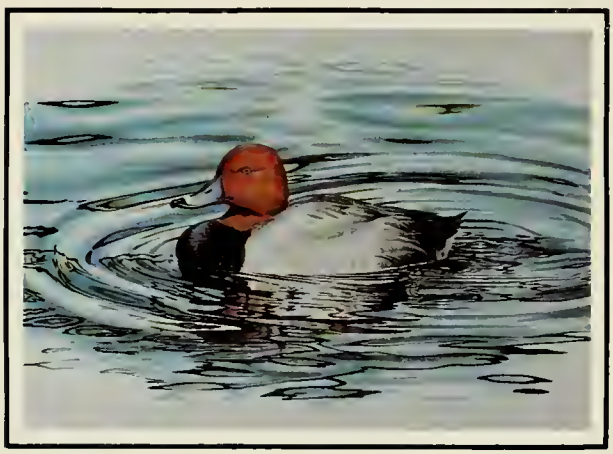
The 1987 judges included Herb and Diane Hazen, gallery owners and art publishers; Harold Price, representing the Montana Wildlife Federation; Arnold Olsen, administrator of the Department of Fish, Wildlife and Parks (DFWP) Wildlife Division; Jeff Herbert, DFWP statewide waterfowl coordinator; and Ron Clark, an administrative assistant to Gov. Ted Schwinden.

All of the entries were unsigned, and participating artists were not identified until all ballots were tabulated. The judges selected from 58 entries.

Cruwys' winning entry and the paintings of the seven finalists are 'on tour' of various Montana art galleries.

The 1985 Montana Legislature gave the DFWP authority to produce and sell the waterfowl hunting stamp. In 1986, for the first time, waterfowl hunters in Montana were required to possess a state waterfowl stamp as well as the long-required federal "duck stamp." Last year, more than 17,000 stamps were sold to Montana waterfowl hunters, and several hundred collector's stamps were sold throughout the country.

Proceeds from sale of the waterfowl stamp and related artwork will be used exclusively to develop and enhance Montana's wetlands. The major thrust of the program is to enhance wetlands for the long-term benefit of waterfowl on cooperating private, federal, and state-owned lands. ■

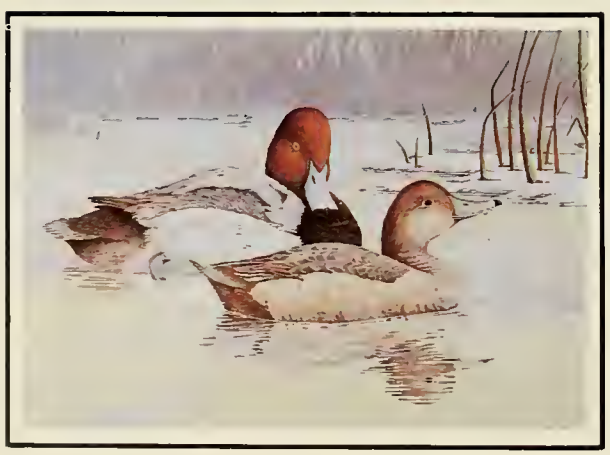


Second Place—Dave Samuelson, Missoula
(untitled)

Samuelson is a full-time artist who only recently began painting after a long career as a sculptor. A former assistant instructor of sculpture at the University of Montana, he has become a frequent contributor to Montana Outdoors.

Third Place—Charles Fritz, Billings
"Brisk Wind Redheads"

Fritz is a full-time artist whose works have won many awards. Ducks Unlimited and L.L. Bean are among the organizations and businesses that have commissioned his paintings. He has also worked under contract with Midwest Galleries and American Masters of Houston.

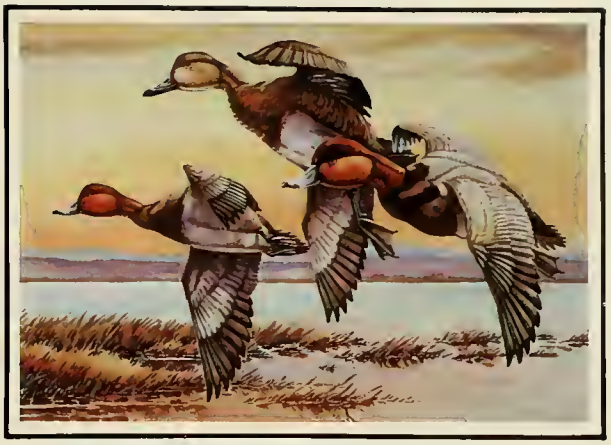


Fourth Place—Dave Maloney, Great Falls
"Redheads in the Morning's Glitter"

Maloney was the 1986-87 Ducks Unlimited Sponsor Artist of the Year for Montana and Wyoming. He was a finalist in Montana's first waterfowl stamp competition in 1986, and his 1984 entry in the federal duck stamp competition was judged as one of the top entries. He is a full-time artist who contributes frequently to Montana Outdoors.

Honorable Mention—Robert A. Kercher, Great Falls
"Redheads"

Now a full-time artist, Kercher formerly headed C.M. Russell High School's art department. His work has graced the Helena home of Gov. Ted Schwinden and has been accepted for the Alaskan National Exhibition of Alaskan Wildlife. His work is often seen in Montana Outdoors.

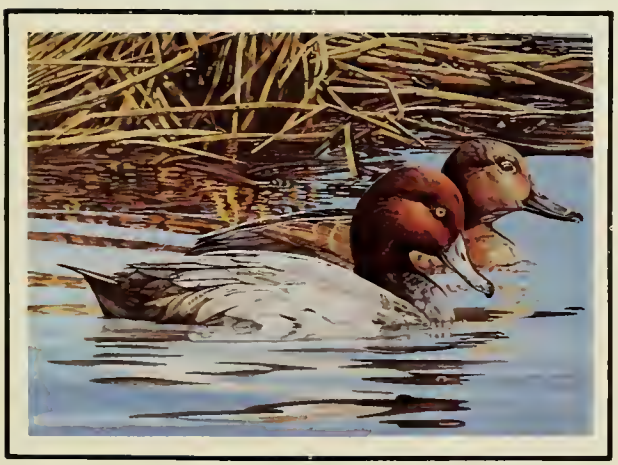


Honorable Mention—Steve Aller, McLeod
"Redheads"

Aller calls himself a "full-time rancher and half-time painter." The 1987 waterfowl stamp competition was the first state competition he has entered.

Honorable Mention—Robert W. Billie, St. Ignatius
"Misty Morning at Nine Pipes"

A full-time artist, the 1987 Montana waterfowl stamp competition was the first state competition Billie has entered. He has studied art at the University of Montana. A Choctaw Indian, he is working on a "history of Indian cultures in image and verse" as well as plans for a Choctaw history museum in his native Mississippi.



Honorable Mention—Stephen C. Elliott, Billings
"Redheads"

Elliott is a part-time artist and a full-time physician. His painting of two Canada geese in flight was a finalist in the 1986 waterfowl stamp contest.

PERSPECTIVES

"Everyman's Old Man of the River" by Tom Palmer

Of the many ways to mark time, Pat Barnes has discovered one that makes good sense. Forget phases of the moon and, at the risk of sacrilege, forget the common "B.C." and "A.D." calculations. For an ardent fly fisherman like Barnes, time is marked thus: "Before (Dan) Bailey" and "After Bailey."

Dan Bailey abandoned a career as an atomic physicist, before Oppenheimer even set foot in Los Alamos, to tie flies for the world's fly fishermen. He did so from a modest storefront in Livingston, Mont. His decision to forsake splitting atoms for splitting elk hair has forever changed the course of light tackle sport fishing. As devoted to trout fishing and to the promotion of Montana's rivers as a scientist is to research, Bailey alone is often credited with turning the conservation floodlights on a resource most Montanans took for granted.

"I think he did an awful lot of the things I wanted to do for Montana," Barnes told me one day. "He did a terrific job for the rivers."

The topic, as I recall, was heroes and the irony of Antrim "Pat" Barnes becoming a living legend to a growing number of grown-up fly fishermen. Anyone who has ever floated the Madison, Big Hole, or Yellowstone rivers more than once has acquired a Pat Barnes story. The prologue usually has something to do with spotting an old man at the oars of a McKenzie boat about to enter a treacherous stretch of water. A terror-of-the-river narrative follows. And then the epilogue: "Until I recognized him, I would never have believed that ol' Pat Barnes was still at it."

The story, with several variations woven through it, is essentially true. With a Kelly-green boat, emblazoned with "YE OLD PRO" on the gunwales, the 78-year-old Barnes is a cinch to spot on the river. Last year, Barnes guided seven trips—a couple at the request of long-time customers and the remainder for corporate high rollers who outbid their colleagues for a Pat Barnes-guided outing at Trout Unlimited fund raisers. Barnes, who says his legend or hero status has emerged only because he's "just been around longer than anyone else," intends to keep his outfitting in the realm of old friends and limited fund raisers. But when he's not professionally guiding, he's pleasurably fishing. So visibility, if not his endurance, has provided the fodder for the "ye old pro" fable now established in Montana fly-fishing folklore.

Pat Barnes is Everyman's old man of the river. A member of the original clan of West Yellowstone river guides, Barnes began guiding out of West Yellowstone in the late 1930s. Over the years, he and his wife, Sig, have been credited with inventing several "essential" flies, including: the goofus bug, the sofa pillow, and the H. & L. Variant.

Barnes was also the first guide to freight a cargo of fishermen down the Madison River in a McKenzie boat, but Bailey, "the old-fashioned, small stream fisherman," and others soon saw the beauty of boat fishing and captained similar dories down the Madison.

These days, Madison River travel during the famed salmon fly hatch can be as hectic as ball game traffic in Boston. But nearly 50 years ago, fishing out of West Yellowstone was something else again for a kid who spent his youth fishing the trout-rich waters of Three Forks with a cane pole and hoppers. It was After Bailey when the sport of fly-fishing became a science and, for many, a religion.

If Dan Bailey was the high priest of fly-fishing, young Pat Barnes was a most worthy deacon. He put himself through college, in part, with money earned by tying flies for Dan Bailey. Before Bailey, Barnes tied his own flies, and anything that came close to the flies that Dr. George Parker placed in his 1919 seminal classic, "Streamcraft: An Angling Manual," seemed to work just fine. So, with the confidence of youth, Barnes approached Bailey to ask if he could tie him some flies. "I was pretty cocky," Barnes recalled.

"Have you ever tied flies, Pat?" Bailey asked.

"Sure, Dan," Barnes said. "Heck, I tie them all the time."

Bailey handed over the material and had Barnes try a dozen or so Royal Wulff patterns, which are generally regarded as easily tied flies. And Barnes had at it, discarded a fly here and there, used a few of his own hooks, and proudly returned to Bailey's shop with the 12 Royal Wulff flies.

Bailey examined the flies carefully, and he did not hide his disappointment. Here the thorax yarn was too bulky and there, too thin. The hackle was once too long and then, too short. There was no symmetry between patterns. Sure, they might work on the river, Bailey said, but there was no way he could sell them. Each pattern had to be identical because if a fisherman had a fine Tuesday using a Dan Bailey fly, when he came back Wednesday for five more, those flies had to be the *same* fly. "And," Bailey said, uncustomarily annoyed, "where ever did you get these hooks?"

Lesson learned, Barnes said, "That's when I began to concentrate on details and the following year I worked for Bailey all summer. I'd tie flies for 10 hours and then I'd fish, sleeping as little as I could to get by."

Bailey kept the shop open seven days a week. One Sunday, Barnes offered to give up his fishing holiday and convinced Bailey to take the day off to go fishing alone. "I'll watch the shop," Barnes told Bailey. "Go fishing."

At day's end, Bailey came back to the shop as Barnes was preparing to close up. It had been a banner day for sales, and when Bailey counted the till, he couldn't fathom how Barnes alone handled the customers that accounted for the day's take. "He didn't say a thing," Barnes said. "He just took out a $10 bill and gave it to me. That was a lot of money!"

In 1942, when he was called to the war in Europe, Barnes boarded the train in Wilsall, Mont., but not before Bailey surprised him at the station. "He was the last to see me off," Barnes recalled. When reminiscing, Barnes closes his eyes and tilts his head back, as if his memories were being projected like a newsreel inside his head. "We talked fishing," Barnes said. "We always talked fishing." He smiled, opened his eyes, and pushed the coffeepot across

the table to me.

A fisherman's fisherman, I thought.

Barnes has pursued his avocation all over the world—he particularly enjoys New Zealand's trout fishing—and he still spends those fall weekends, that no longer creep so gently into winter, jump-shooting ducks along the spring creeks down Three Forks way.

And for Barnes, that's where the sporting life was born. "What else was there for a boy growing up in the little town of Three Forks to do but fish?" Barnes asked. "It was a wonderful place." Although Barnes is certainly the "old pro," it occurred to me that unlike many of his contemporaries, and unlike some who have come since, fishing has been a passion but not a singular profession. For more than 30 years, Pat Barnes taught the problem-solving disciplines—science and math—at Helena High School. In summer, he and Sig packed up the kids and opened up the West Yellowstone fly shop.

Maintaining two professions might have been a matter of economics, but then, knowing Pat Barnes, it was probably a matter of perspective. "I always felt when people hired me as a guide," Barnes said, "they were hiring me to use all the information I'd learned to help them catch fish and to give them a good picture of what was going to happen. Over the years, I've had a lot of association with a lot of people and I think more than just fishing, it was a question of getting people to know and understand a resource."

It was a question of teaching fishermen how to become sportsmen. "It doesn't matter if you catch one fish or 10 fish," he told me. "The fisherman, the sportsman, has the desire to have a good day and that means knowing about the habitat, watching osprey and eagles, mink and muskrat. It's not just the fishing he enjoys, but he enjoys the outdoors—the insect life and the birds feeding. The life of a stream gives you something to compare your life to."

Is that silly? A little too romantic for this cynical decade? If you ever saw Barnes on the river, gracefully throwing 50 feet of line in a master's loop out to a three-pound rainbow about to rise to a No. 16 Adams, it would make you wonder.

Not too long ago, one of the corporate high rollers called Barnes and said he had to go fishing. Barnes remembered him well because he was a big man, in physical stature and in confidence.

Barnes agreed to take him out and when he arrived in town, the man said, "Pat, I don't want to kid you." The man opened his shirt to show how his chest had been cut away in surgery. He was dying of cancer. "Pat, I just want to catch a fish," he said. "Like we used to."

Barnes loaded the boat and helped the man aboard. It proved to be a difficult day; the fish were stubborn and not biting. Barnes explained that some days no fly pattern under the sun can tempt a fish to rise, and this appeared to be such a day. It was a phenomenon that Barnes and Bailey often discussed.

On the water for only a short time, it also became clear that, in addition to uncooperative trout, the man was becoming too weak to cast. Barnes helped him cast and then helped him hook a small trout. It was nothing like the big fish the two caught years ago, but it was still too big for the man to land alone. Barnes had to help him play the fish and reel it in.

Barnes closed his eyes as he told the story, but, as if the newsreel had jammed in the projector, he suddenly stopped. After a few long seconds, he opened his eyes and looked out the window for a moment before closing them again. "The sport of fishing is seeing the problems you run into and somehow solving those problems," he said. "That's the sport of it. Sometimes you do everything you can, but there are some days nothing seems to work. I haven't been able to solve that problem."

Barnes leaned across the table to refill my coffee cup. I was about to ask if he was referring to fly-fishing in general or to his struggle to satisfy the man's final day on the river, but it didn't seem to matter. There was more to the legend of Pat Barnes than his ability still to row a drift boat. The qualities of the man that Dan Bailey must have recognized early on, after a three-year acquaintance, I was just beginning to understand.■

DAVE SHORS

Pat Barnes

Bruce Rehwinkel, DFWP biologist, demonstrates fisheries management techniques for Montana Summer Science Camp students. Classroom activities (below) include analyzing the chemical makeup of lake water using a spectrophotometer.

The Search for Moby

story and photos by Gil R. Alexander

The Sunday evening sun was setting as fluffy clouds became awash in pink and gold. The lake exhibited that glassy stillness that so often signifies the arrival of twilight. It was as though the hustle and bustle of weekend boaters, fishermen, and water skiers had worn the energy from the waves and the lake was ready for a rest. I sat in awe of the lake and let the glory of the evening engulf me. Tomorrow morning, July 7, 1986, a new group of students would arrive at the Community Center at Canyon Ferry Reservoir to begin the third year of a project known as the Montana Summer Science Camp.

The camp had its inception late one summer afternoon in 1982, when my wife and I watched great green globs of algae peel away from the bow of our boat as we returned to the Silos Recreation Area after a day of successful fishing. While most folks regard the algae as a nuisance, we reflected on the potential of this crop of microscopic plants as a wonderful chance for scientific investigation. We both teach high school science courses in Helena. Marilyn teaches chemistry at Capital High School, while I teach earth science at Helena High School. That afternoon, questions raced through our minds regarding the potential of this stuff for use as fertilizer, for methane production, for cattle feed supplement, or whatever else. We decided then and there to involve some of our students in these questions.

When 1983 came, our plan got shoved aside until we took a field trip to the University of Montana Biological Station at Yellow Bay on Flathead Lake. Again, we were reminded of the thick crop of algae on Canyon Ferry the year before. Dr. Jack Stanford, director of the Biological Station, is intensively studying the effects of nutrient loading in Flathead Lake and the algae crop there. Much of the research is carried on by students seeking post-graduate degrees in water quality. While we were there we formulated a plan that could involve high school students in similar studies on Canyon Ferry Reservoir. Of course, these studies would be less sophisticated than those conducted at Yellow Bay, but the principles would be the same.

Canyon Ferry is more than Montana's most popular recreation lake. As the uppermost large impoundment on the Missouri River—more than 2,800 miles from where the Missouri enters the Mississippi—whatever happens to Canyon Ferry, ecologically, can ultimately be transferred far downstream. We considered the reservoir, therefore, of significant scientific importance and worthy of long-term study.

During the 1983-84 school year, we convinced four of our students that a summer study of lake ecology held both excitement and challenge. So it was that in July of 1984 our students were collecting algae samples from the reser-

for Pike

In the above photo, Matt McCluskey (left) and Steve Wetzel (right) use a minnow seine to search for northern pike fry. Above left, Kim Gilleland samples surface algae with a plankton net.

A search for northern pike minnows was only one of many research projects to draw students to a summer science camp at Canyon Ferry Reservoir.

voir near the Silos Recreation Area when we heard that Canyon Ferry was experiencing a toxic algae "bloom" (see "Those Bloomin' Algae," *Montana Outdoors*, July/Aug. 1985). Some cattle at a nearby ranch had died shortly after drinking water from the lake. The villain was *Anabaena flos-aquae*, a species of blue-green algae commonly found in Canyon Ferry in non-toxic form. Temperature, nutrient level, wind action, and everything else that affects the growth of these algae had been just right for them to become toxic.

The news gained statewide attention and the students realized they were in the unique position of being on the spot when the discovery was made. We continued to collect the algae and investigate other reservoir conditions of temperature and chemistry. Needless to say, the students became keenly aware of water quality and the delicate balances that nature provides.

During the following school year, those students talked to their friends

about the challenge of studying science in the field with the added attraction of being on the reservoir, of learning to operate boats, water ski, fish, and of having evening picnics and campfires along the shoreline. The lure of the reservoir, combined with the chance to do meaningful research, convinced nine students to join us for two weeks in July of 1985. Our second season was soon under way, but with some differences.

We had contacted Steve Clark, supervisor of the Bureau of Reclamation's Canyon Ferry Project, and he had graciously allowed us to use the Community Center at Canyon Ferry Village near the dam. This would serve as classroom, dining room, and laboratory area. We were also allowed to use the nearby boat docks for mooring our two boats and a rubber raft. Students were taught to operate the boats safely, so that they could independently gather data whenever they had the chance.

Our main thrust for this two-week session was to gather data on four aspects of lake ecology: We wanted good water chemistry information, accurate temperature profiles of the reservoir and bays, photos of all the microorganisms we could identify from our water samples, and detailed topographic maps of the lake bottom. The latter was done with the aid of a Lowrance X-15 sonar graph recorder, which allowed us to map the lake bottom with five-foot contour intervals in selected high-use bays and 10-foot intervals for the main lake. In addition, in the evenings we listened to guest speakers from various agencies and organizations involved with the reservoir's management, studied astronomy, and on weekends we took field trips through the power plants at Hauser and Canyon Ferry dams.

Our nine students worked long hours and were diligent in their efforts. The data they gathered were stored on a computer disk and will become useful as baseline information in the future. The students continued to work on their projects through the following winter, developing a slide presentation and videotape to show what they had accomplished. They eventually gave presentations to their peers, parent groups, the Montana Science Teachers Association, the Montana Gifted and Talented Association, and local civic organizations.

Camp No. 3 began in the summer of 1986 with eight of the nine students from the previous summer returning. The ninth wanted to return, but she was selected to do research at Montana State University under a fellowship from the American Cancer Society. We also had several new students, for a total of 23, which required that we hold two separate sessions. We found that we were best able to supervise 12 students divided into four teams of three students each. In addition to the 12 students in the second camp, several students from the first camp decided to return to work on their individual projects while the second session was in progress. This meant we sometimes had as many as 18 or 20 students sticking around for dinner. Isn't it strange how so much is written about today's students not being eager to learn?

What had begun as a modest, four-student program in 1984 was now rapidly expanding, thanks to funding from a variety of sources: the Office of Public Instruction's Gifted and Talented Program, Helena School District No. 1, the Last Chance Chapter of the Audubon Society, the Helena High Science Club, and the Capital High Science-Math Research Organization. Steve Clark again made us feel welcome at the Canyon Ferry Community Center, and personnel from the Montana Department of Fish, Wildlife and Parks (DFWP), the U.S. Bureau of Reclamation, the Astronomical Institute of the Rockies, the U.S. Geological Survey, and Lovestone Mining Co. generously contributed their time and expertise.

One evening Bruce Rehwinkel, a DFWP biologist, visited our camp to talk about fish management on the reservoir. He asked if one of our students would be interested in looking for northern pike minnows—it seems a few of these toothy monsters have been reported in Canyon Ferry over the past few years, but there is no record of spawning. There is some fear that northern pike, which may have been illegally introduced, could threaten the redevelopment of a successful trout fishery. Several students expressed a desire to pursue this project, which they affectionately named "The Search for Moby Pike." After seining approximately 50 locations, however, we have not located any northern pike minnows. Yellow perch fans can rejoice, though, because these delectable table fish made a strong showing in the seines.

One morning near the end of the second session, I arose to a soft rain and a glorious sunrise. The lake was dappled by the light rain and the sky was slowly transformed from a burnished gold to a deep red. A rainbow, almost too pale to notice, whispered its way downward toward the southwestern shoreline. I took a few moments to reflect on the summer's accomplishments.

Engrossed in their work, our students had averaged 14- to 15-hour days, beginning by 8 a.m. and usually finishing by 10 or 11 p.m. They had learned that the sciences must be integrated to provide an overall picture of the lake's ecology. Our old friends the algae were back in their bloom cycle—more abundant than in 1985, but down from 1984. The lake's surface temperature had been averaging between 66 and 70 degrees. Most of the fish we had located were south of the sandbar outside the mouth of Magpie Bay; they were at a depth of 20 to 50 feet, where the water temperature was in the 65-degree range. Most of the fishermen, however, were concentrated on the other side of the lake, having little luck!

The kids had become adept at using a taxonomic key to identify the various species of algae, at taking biomass samples, at determining water chemistry, and at plotting temperature data. They had had a hard time getting accurate phosphate results but had finally developed an acceptable procedure. In addition to all of their required work, many students had taken on extracurricular research projects—for example, cataloguing photos of the lake's microscopic life forms, comparing the relationships between phosphate levels and biomass concentrations, and analyzing the distribution of minnow types taken from seine samples.

As the 1986 camp drew to a close, many students spoke of returning the next year. The time had gone too quickly. They were bubbling with anticipation, charged with self-confidence, and eager to explore new ideas. They had become young scientists.■

Piscatorial Prophecies

LARRY PETERMAN

This aerial view shows the Clark Fork River immediately downstream from the Warm Springs ponds. Lighter areas are tailings deposits where toxic metals have prevented vegetation from growing.

by Glenn Phillips

The distribution of brown trout in the upper Clark Fork River has probably received as much local attention as the state budget deficit. Even the corner barber in Deer Lodge cites statistics on the number of brown trout per mile for each of the major river segments—more than a thousand near Warm Springs, a couple hundred near Deer Lodge, a dismal few dozen near Bearmouth, a respectable five hundred or more below Rock Creek. How do you explain it? What are the factors that control brown trout densities in the river? Why do the population numbers fluctuate so wildly as you move downstream? Why are rainbow trout absent from most of the upper river?

As much attention as the Clark Fork has received in recent years, one would think the answers to these questions would be on the tip of the tongue of every researcher who has sported a pair of wading boots and floundered out into the water. However, in the Clark Fork's case, the number of theories to explain fish distribution trends are nearly as numerous as the trout. Clearly, the answers to these questions are not as easily determined as one might imagine.

What then *are* some of these theories and which of them hold water? Following are some of the explanations for the distribution and abundance of brown trout in the Clark Fork and a discussion of the relative merits of each.

Tailwater Effect. River fish populations are sometimes enhanced immediately downstream from impoundments, providing what is commonly called a "tailwater fishery." Examples in Montana are downstream from Yellowtail Afterbay Dam on the Bighorn River, Holter Dam on the Missouri River, and Clark Canyon Dam on the Beaverhead. This happens for several reasons. Water released from the bottom of reservoirs is often cooler in the summer and warmer in the winter than it would be without the dam. Such conditions can favor trout. In addition, impoundments are often biologically more productive than the rivers that flow through them because they have more surface area reached by the productive rays of the sun. Living organisms produced in reservoirs are sometimes carried downstream, adding to the food supply for river fish.

The Warm Springs Ponds are not deep enough to improve the water temperature of the Clark Fork; however, the ponds are productive and the algae produced in them provides food for invertebrates living in the Clark Fork River. Studies of invertebrate populations in the Clark Fork show the density of food organisms is unusually high immediately downstream from the ponds—higher than in other reaches of the river. A large percentage of this food is plankton-feeding insects, pri-

marily caddis fly and black fly larvae, that feast on algae which they ingeniously pluck out of the stream water as it floats by. The higher density of food downstream from the ponds probably contributes to the higher density of fish in this reach. If you're hungry, you get in the food line—it's as simple as that.

However, brown trout populations in the Clark Fork decline much more rapidly in the downstream direction than in other rivers where tailwater fisheries are enhanced. In fact, biologists who conduct fish population estimates have noticed a significant decline in fish numbers only a few miles below the ponds. Moreover, trout densities between Deer Lodge and the confluence with Rock Creek are much lower than in other rivers in the drainage basin which are about the same size as the Clark Fork, e.g., the Blackfoot River and Rock Creek. Surely, something must be wrong.

Physical Habitat. Fish numbers are partly controlled by the quality of the physical habitat. Among other things, fish need undercut banks and pools in which to hide, riffles to produce food organisms, clean gravels for spawning, and suitable areas for rearing young.

The suitability of physical habitat in a given reach of stream is difficult to quantify, and researchers have never thoroughly assessed the upper Clark Fork. Nonetheless, some changes are noticeable in the Clark Fork River channel as you move from Warm Springs to Milltown. For example, the Warm Springs reach has tighter meanders and more pools per given length of stream than reaches farther downriver. Still, the channel configuration in various downstream segments of the Clark Fork is similar to other Montana rivers that support healthy populations of trout. Moreover, a limited habitat assessment during summer of 1985 failed to reveal habitat differences in the various river segments that would account for the differences in trout abundance.

Biologists surveying fish populations in the Bearmouth section of the Clark Fork have noted unusually heavy sediments in this reach of the river during certain seasons. Fine sediments and sand fill in the spaces between spawning gravels, restricting the flow of water and choking off the oxygen for developing fish embryos and fry. Information on the suitability of the Clark Fork River bottom for spawning may provide some clues about brown trout abundance.

DAVE BOOKS

Brown trout are the mainstay of the Clark Fork River fishery. Densities vary atmost twentyfold between the reach immediately downstream from the Warm Springs ponds and the Bearmouth reach, located a few miles upstream from Rock Creek.

ERIC WEBER

This section of riverbank near Deer Lodge shows evidence of tailings; the blue areas are copper crystals which are commonly washed into the river during periods of high stream flow.

Spawning Migrations. In many rivers, fish migrate into smaller tributaries to spawn. From the Clark Fork, brown trout migrate into Warm Springs Creek, the Little Blackfoot River, and probably into Rock Creek, Lost Creek, and Gold Creek. However, we do not know the importance of the recruitment of young fish from each of the tributaries to the various segments of the mainstem, nor do we know whether successful spawning occurs throughout the mainstem. Quite possibly, the availability of suitable spawning tributaries influences the distribution of fish in the river. Two of the most productive fishery sections are located near tributaries—Warm Springs Creek and Rock Creek. However, this does not explain the relatively low populations downstream from the Little Blackfoot River; more information is needed on this important subject.

Water Temperature. Some people have suggested that brown trout occur in lower densities in the downstream reaches of the Clark Fork because of water temperatures. Indeed, water temperatures are higher near Deer Lodge than at Warm Springs and higher yet in the Bearmouth area before Rock Creek enters the Clark Fork and adds its cooling influence.

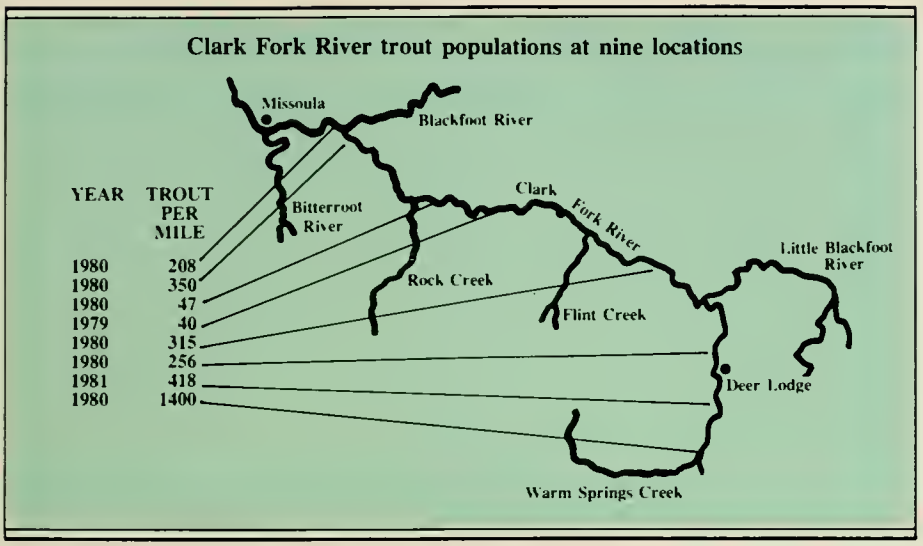
In reality, however, water temperatures in the Clark Fork— even in the Bearmouth section—are no higher than in reaches of other Montana trout streams (such as the Greycliff section of the Madison River) that support thriving trout populations. Temperature alone cannot explain fish distribution trends in the river.

Metals Toxicity. Concentrations of some metals in the Clark Fork River annually exceed criteria for protection of aquatic life. Copper, in particular, is a frequent culprit. Biologists believe that during the spring runoff, exposure to these chronically stressful concentrations of metals causes subtle effects on sensitive early life stages of trout resulting in lower fish numbers.

The Environmental Protection Agency attempted to evaluate the toxicity of the river to rainbow trout fry in spring of 1985. However, results were inconclusive because stream flows were much lower than normal during the 1985 spring runoff. (Spring runoff is the event that normally causes metal concentrations to escalate.) Similarly, in-stream toxicity tests conducted by the Montana Department of Fish, Wildlife and Parks (DFWP), using fingerling rainbow trout, in May and June of 1986 provided no conclusive results. Again, spring runoff was lower than usual; moreover, flooding in late February and early March probably washed away surface deposits of metals that would normally have entered the river in spring. Biologists will repeat these tests in spring of 1987.

Critics argue that if fish are harmed by metals toxicity, why then are the highest brown trout densities in the Warm Springs area, near the source of the problem? This confuses the issue, but the answer may be surprisingly simple: Water quality appears better in the Warm Springs reach than in reaches farther downstream.

Water quality information collected during 1984 and 1985 by the Water Quality Bureau of the Montana Department of Health and Environmental Sciences and the DFWP demonstrates that metals most often exceed the "safe" criteria between Deer Lodge and Bearmouth. This happens because the river



picks up metals from tailings deposits along the banks as it moves away from Warm Springs. Length of exposure to pollutants is important, particularly since longer exposure accentuates the subtle population changes (fewer eggs per female, lower egg and fry survival, etc.) that result from chronic toxicity.

Not surprisingly, fish populations begin to increase downstream from Rock Creek where water quality improves significantly because of the clean dilution water entering the river. It is hard to imagine that the parallels between metals concentrations and fish densities are coincidental.

Water Characteristics, Toxicity. A number of chemical influences affect the toxicity of metals. Water hardness (determined primarily by calcium and magnesium ions) tends to be inversely related to metals toxicity—toxicity increases as hardness decreases. The reason is not known for certain, but scientists believe these ions compete with metals at the surface of the gills of a fish, ultimately lowering the amount of metals entering the fish's bloodstream. The hydrogen ion concentration—expressed as pH—is also important because the solubility of most metals increases as pH decreases (dissolved forms of metals are more toxic than undissolved forms). Finally, alkalinity (primarily carbonate and bicarbonate ions) is important because more alkaline waters are more resistant to changing pH. This characteristic is called "buffering capacity" and is a result of the alkalinity ions scavenging the hydrogen ions out of solution, rather like a sponge removing water from a counter top.

Some people have figured that the river gradually depletes its buffering capacity as you move downstream from Warm Springs, causing metals toxicity to increase. This theory has been used to explain the decline in fish numbers as one moves downriver. However, information collected by the DFWP during spring of 1986 (the season when metals concentrations are generally highest) indicates that alkalinity and hardness are similar (and sometimes even lower) in the Clark Fork below the ponds than in downstream reaches (until the confluence with Rock Creek). In other words, buffering capacity remains the same or *increases* downstream.

Interestingly, however, the average pH in May and June of 1986 was highest downstream from the ponds—averaging four-tenths of a unit higher than at Deer Lodge. The higher productivity of the ponds probably accounts for this; photosynthesis by algae and other aquatic plants during the day reduces carbon dioxide concentration which in turn increases pH. Higher pH in the river below the ponds could reduce metals toxicity. Unfortunately, we do not know the extent to which pH fluctuates over an entire day. We need much more information to determine if this is a significant trend and whether it influences the success of the fishery.

Where Are the Rainbows? Rainbow trout are conspicuously absent from most of the upper Clark Fork upstream from Rock Creek. This is particularly surprising because other streams in the drainage—most notably Rock Creek and the Blackfoot River—support flourishing rainbow trout populations. Rainbows begin to show up in the Clark Fork downstream from Rock Creek; from Milltown Dam downstream, they are the predominant trout species.

A review of material written on metals toxicity reveals some interesting points. Copper, the metal believed to be of greatest significance to aquatic life in the Clark Fork River, is much more toxic to rainbow trout than to brown trout. During laboratory experiments, rainbow trout eggs were unable to survive at copper concentrations in water as low as 37 parts per billion; 555 parts per billion of copper produced the same effect on brown trout eggs. When rainbow trout eggs incubate in gravels in the Clark Fork upstream from Rock Creek during spring and early summer, copper concentrations are frequently between 30 and 100 parts per billion, a range expected to be lethal. Occurrences above 30 parts per billion are less frequent downstream from Rock Creek where rainbow trout successfully survive. Simply put, the predominance of brown trout over rainbow trout in the upper Clark Fork may reflect their relative resistance to copper toxicity.

The Answer? There is a great deal we do not understand about the Clark Fork River and its fishery. Intuitively, it seems that all of the factors discussed in this article have some bearing on distribution and abundance of fish in the river. However, until the necessary information has been collected, we must live with a degree of uncertainty.

Thomas Malthus, an acclaimed population biologist who lived in the late 1700s, wrote: "Through the animal and vegetable kingdoms, nature has scattered the seeds of life abroad with the most profuse and liberal hand. She has been comparatively sparing in the room, and the nourishment necessary to rear them. The germs of existence contained in this spot of earth, with ample food, and ample room to expand in, would fill millions of worlds in the course of a few thousand years. Necessity, that imperious all-pervading law of nature, restrains them within the prescribed bounds."

Our challenge in the Clark Fork is to sort out the natural boundaries placed on fish population growth from those for which man is responsible. Once we have identified the self-imposed constraints, we can begin the task of doing what we can to remove them. Maybe then we'll have an opportunity to find out what the Clark Fork's "spot of earth" is capable of producing.■

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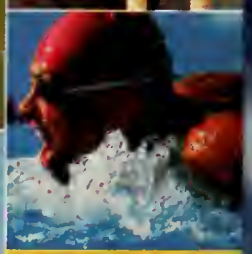

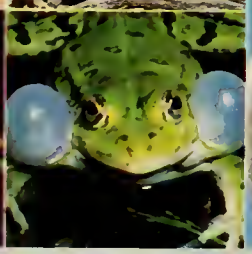

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